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Art. I.—THE SCIENTIFIC VALUE OF THE MICROSCOPE.

1. *A Practical Treatise on the Use of the Microscope, including the different Methods of preparing and examining Animal, Vegetable, and Mineral Structures.* By John Quekett, Assistant Conservator of the Museum, and Demonstrator of Minute Anatomy at the Royal College of Surgeons of England. London: 1848. 8vo. pp. 454.
2. *Die Infusionsthierchen als volkommene Organismen.* Von Dr. C. G. Ehrenberg. Leipzig: 1838. folio.
3. *Die fossilen Infusorien.* Von Dr. C. G. Ehrenberg. Berlin: 1837. folio.
4. *Mikroscopische Untersuchungen über die Uebereinstimmung in der Struktur und dem Wachsthum der Thiere und Pflanzen.* Von Dr. Th. Schwann. Berlin: 1839. 8vo.
5. *Odontography; or a Treatise on the Comparative Anatomy of the Teeth, their Physiological Relations, Mode of Development, and Microscopic Structure, in the Vertebrate Animals.* By Richard Owen, F.R.S., Hunterian Professor to the Royal College of Surgeons, London, &c. &c. London: 1840-5. 8vo.
6. *Report on the Microscopic Structure of Shells.* By William B. Carpenter, M.D., F.R.S., &c. &c. From the

Reports of the British Association for the Advancement of Science for 1844 and 1847. London: 8vo.

7. *Report on the Origin and Functions of Cells.* By William B. Carpenter, M.D., F.R.S., &c. &c. From the British and Foreign Medical Review, No. xxix. London: 1843. 8vo.

8. *The British Desmideæ.* By John Ralfs. The Drawings by Edward Jenner. London: 1848. 8vo.

Few are cognizant, we suspect, of the recent improvements on the Microscope; though they have been such as to have raised it, within the last quarter of a century, from being little more than a scientific toy, to the dignity of a most perfect instrument of research. And yet fewer, probably, are aware of the varied conquests which it has achieved during that short period:—though its recent discoveries will bear comparison, in point of rapidity, novelty and importance, with those of any other epoch of similar length in the history of Natural Science. As an optical instrument, the microscope is now at least as perfect as the telescope, and its revelations altogether as surprising. The universe which it brings within our ken, in one direction, is as unbounded in its limits, as that whose remotest depths the most gigantic telescope still vainly attempts to fathom in another; and greater wonders of organization are disclosed in a speck of inconceivable minuteness, than the most mysterious nebula of the astronomer can exhibit to us. But more than this:—the generalizations in the phenomena and science of Life, to which its researches lead us, will be found as simple and comprehensive, as any which physics or chemistry have yet afforded. We propose to give our readers the opportunity of judging of the grounds of our assertions.

We need not dwell at any length upon the history of the microscope. Those who are curious in the matter will find a very complete account of it in the Introductory Chapter of Mr. Quekett's Treatise. It is sufficient to mention that, whilst the *simple* microscope, or magnifying glass, was known at a very remote period, the *compound* microscope,—the powers of which, like those of the telescope, depend upon the combination of two or more lenses,—was not invented until about the end of the sixteenth century;

the earlier microscopes having been little else than modified telescopes, and both instruments having been first constructed, it would appear, by the same optician. From that period, almost to the present time, the microscope remained nearly stationary; no essential improvement was made in the optical principles of its construction, and but little in the mechanical appliances by which those principles were turned to account in practice. Every one possessed of a smattering of optical knowledge is aware that, in the passage of light through lenses of ordinary construction, there are two serious causes of error or aberration. Of these, one depends upon the spherical curvature of the lens; in consequence of which, the rays that have passed through its outer portion, meet in a focus much sooner than those which have passed through its central part, thus communicating a certain indistinctness to the image. The other is occasioned by the dispersive power of glass; the consequence of which is, an unequal refraction of the different rays of the solar spectrum, and the production of a series of coloured fringes around every line or spot in the picture, totally destructive of a clear view of any portion of it. The first of these aberrations is termed *spherical*, the other *chromatic*. The only method at first thought practicable for preventing them from rendering both telescope and microscope virtually useless, was to contract the aperture of the lenses, so as to allow only their central portions to be in use. But this bungling expedient was necessarily attended with a great loss of light, especially when lenses of high power were employed: and in fact, it did nothing to *correct* the errors; it merely restrained their action within certain limits. Under these circumstances little could be expected from either the telescope or the microscope, as an instrument of scientific research, without a complete change in the principles of their construction. Despairing of such a change in the refracting telescope, Newton devoted himself to the improvement of the reflecting instrument. But in the middle of the eighteenth century, the want of uniformity between the refractive and dispersive powers of different transparent media was fortunately discovered: so that Dollond was enabled to construct compound lenses, in which the errors of the several component parts balanced or corrected each other, and an

image was produced free from both chromatic and spherical aberration. From that period to the present, refracting telescopes have been constructed upon the achromatic principle; and the only limit to their power lies in the impossibility of procuring glass of a quality sufficiently pure and homogeneous for lenses of more than fifteen or sixteen inches in diameter. But this limit, as long as it remains such, must oblige astronomers still to rely on the reflecting telescope, as their greatest and last resource.

Looking back from our present point of view upon the history of the past, it cannot but excite surprise that no systematic attempt should have been made by Dollond or his successors, to introduce the achromatic principle into the construction of the microscope, considering that its alliance with the telescope is so intimate. The idea, however, would seem to have been regarded as hopeless, in consequence, not of any failure in the principle, but of the practical difficulties that stood in the way of its application. For whilst the progressive augmentation of the capability of the telescope depends on *the enlargement* of the diameter of the object-glass, the increase of its focal length, and the consequent diminution of its curvature;—that of the microscope can only be effected by *the diminution* of the focal length of the object-glass, the increase of its curvature, and the consequent reduction of its dimensions. It was supposed to be impracticable to make the necessary corrections and adjustments, in a combination of lenses, of a diameter sufficiently small to give even the lowest serviceable magnifying power to a microscope; far more, to make such corrections in those minute lenses of higher magnifying power, for the advantageous use of which they were more especially needed. It appears, indeed, that various attempts were made for this purpose towards the end of the last century, and in the early part of the present. But their ill success prevented them from being carried further. Accordingly, we find Professor Amici, about thirty-five years ago, laying aside his experiments respecting the refracting principle, and endeavouring to improve the reflecting microscope, as had been first suggested by Newton. In the year 1823, however, a basis was laid for the improvement of the refracting microscope, by the construction of effective achromatic object-glasses. A combination of lenses on the plan

of the object-glasses of telescopes, was brought to perfection by the late eminent optician Mr. Tulley, working on the instigation of Dr. Goring; whilst a different combination on another plan, since found more suitable to the microscope, was accomplished in Paris by M. Selligues, at the suggestion of M. Chevalier. Similar attempts were made soon afterwards in various other quarters. Professor Amici resumed his labours on the refracting instrument; and the opticians of London, Paris, Munich, and Modena, vied with each other in producing lenses of higher power. Their exertions were crowned with such success, that Dr. Goring declared, in 1829, 'that microscopes were now placed completely on a level with telescopes, and, like them, must remain stationary in their construction.' In that very year, however, Mr. J. J. Lister communicated to the Royal Society his discovery of certain properties in achromatic combinations, which had been previously unobserved. The improvements grounded upon this discovery are so important, that they constitute a new æra in the history of the microscope; and manipulative skill has since realized nearly everything which theory indicates as possible. Taking warning from Dr. Goring, we nowise affirm, that microscopes have now reached their limit of perfection; but we may safely say, that they have so nearly approached it, that a new *principle* of construction must be discovered before any essential improvement can be made in them. The highest magnifying power has been attained, that the microscopist can conveniently employ: the limit being determined by the shortness of the focus, that is, by the closeness of the proximity into which the object-glass must be brought with the object. No lenses of a shorter focus than a twelfth or a sixteenth of an inch can be made available in practice; and achromatic combinations are now constructed with such perfection, as to give a well-defined image of objects magnified from one thousand to two thousand diameters, or from *one to four million* times, reckoning by superficial measure. And the completeness of the corrections made by them is truly marvellous, when we consider that every such combination consists of six distinct lenses, all whose curvatures must be accurately adjusted to the correction of each other's errors, the largest of the lenses scarcely exceeding an ordinary pin's head in

diameter, whilst the smallest may be of the dimensions of the head of the smallest 'minikin' produced by the pin-maker.

The attention of scientific men was early attracted to the compound microscope. In its original and rude form, it opened to them a field of research altogether new, and promised to add largely to their information concerning the structure of every kind of organized body. The Transactions of the Royal Society contain the most striking evidence of the interest taken in microscopic investigations two centuries ago. The early volumes, as Mr. Quekett remarks, 'literally teem' with improvements in the construction of these instruments, and with discoveries made by means of them. The *Micrographia* of Robert Hooke, published in 1667, may be fairly styled one of the wonders of his day; and in 1673, the name of Leeuwenhoek appears for the first time in the Philosophical Transactions. That with the imperfect instruments at his command, he should have seen *so much* and *so well*, as to make it dangerous even now to announce a discovery, without having consulted the works of Leeuwenhoek, in order to see whether some anticipation of it may not be found there, must ever remain a marvel to the microscopist. This is partly to be explained by the fact that he trusted less to the compound microscope, than to single lenses of very high power,—the use of which is attended with much difficulty, but which are comparatively free from the errors inseparable from the other instrument in its uncorrected form. The names of Grew and Malpighi, also, appear as frequent contributors to the early Philosophical Transactions; the researches of the former being chiefly directed to the minute structure of plants, those of the latter to that of animals. Both were attended with great success. Malpighi seems to have been the first to observe the wonderful spectacle of the movement of blood in the capillary vessels of the frog's foot;—an ocular verification of the doctrine of the circulation expounded by the sagacious Harvey. Glimpses of the invisible world of animalcular existence were occasionally revealed to the earlier microscopists. Their curiosity must have been strongly excited; yet they do not appear to have entered on this class of minute investigations with any portion of

the persevering zeal which they devoted to the analysis of higher forms of animal and vegetable structure. Its wonders, however, were gradually unfolded; so that in the various treatises on the microscope, published during the eighteenth century, they occupy a conspicuous place. In the meantime, the microscope had serious difficulties to contend with, some from the nature of the case, some accidental. The defects inseparable from its original construction formed a bar to all discovery beyond certain limits. But it fell under a temporary cloud from another cause. When physiologists began *to theorise* on the elementary structure of the animal body, and to twist their imperfect observations into accordance with their theories, there soon followed a general suspicion of a want of trustworthiness in the microscope, and in everything announced upon its authority. The instrument and its advocates were brought into more or less discredit, the effect of which has continued to attach to them, in the minds of many, until the present day. We wish, therefore, to pause for a moment, and examine into the grounds of this impression.

A tendency, common to all observers, is to describe what they believe and infer, rather than what they actually see. Microscopic observers were especially open to this reproach, as long as a want of definiteness in the image presented to their eyes, left so much to be completed by the imagination. But from the moment that the visual image, presented by a well-constructed microscope, gave as good an idea of the object as we could have obtained from the object itself, if enlarged to the same size, and viewed by the unassisted eye, microscopic observations were made with the same degree of certainty in this respect, as observations of any other class. Another fallacy, common indeed to all observers, but of which the microscopic observations of former times had perhaps more than their share, arose from not sufficiently attending to a difference in the circumstances under which the observations had been made. Thus one observer described the human blood-corpuscles as flattened discs, like pieces of money, another as slightly concave on each surface, another as slightly convex, and another as highly convex, or even globular. Yet all microscopists now agree that their real form, when examined in freshly-drawn blood, is that of

discs with slightly-concave surfaces. The diversity in the previous accounts was simply due to the admixture of water or other liquids added for the sake of dilution, which, being absorbed by the blood-discs, at first rendered their surface flat, then convex, and at last changed their form into the globular. But microscopical inquiries are no longer more exposed to fallacies of this description than any other branch of physiology. And the microscopists of the present day can be only held responsible for the errors of their predecessors, by persons who are ignorant of the perfection which the instrument has now attained, as well as of the general agreement regarding *facts* among all who are competent to use it, however they may differ in their *inferences*.

But our immediate object is to introduce our readers to some of the most interesting discoveries for which we are indebted to the recent improvements in the microscope: and we propose to pass lightly over such as the public may be presumed to be acquainted with, from their having been incorporated into treatises adapted for general circulation. We shall say little, therefore, of Professor Ehrenberg's laborious investigations into animalcular life, as well fossil as recent; although his additions of new forms of organized beings to the catalogue of the naturalist greatly exceed all that have been contributed by the most industrious collector in any other department. It may give some idea of their wonderful variety, to be told that Professor Ehrenberg detected in some specimens of a tertiary deposit, brought a short time since from the island of Barbadoes by Sir R. Schomburgk, no fewer than 1,200 *new* specific forms. It was necessary to create 250 new genera for their reception: the mere naming of which must have constituted in itself no insignificant labour. Professor Ehrenberg first discovered, that various extensive deposits, both calcareous and silicious, are almost entirely made up of the remains of minute organisms; incalculable numbers of which must have successively lived and died, flourished and decayed, leaving the solid portion of their fabrics to accumulate during countless generations, and thus to form vast beds of chalk or strata of silicious sand. One of the most interesting discoveries of this class was recently communicated to the scientific world by Mr. W. C. Williamson.

By means of a microscopic analysis of the white mud, with which the sea-bottom of a great part of the Levant is covered, he has shown that the deposit consists almost entirely of organic forms: and among them may be distinguished the shells of about twenty-five distinct species of animalcules, some silicious, others calcareous; besides certain other bodies hereafter to be noticed, which are determined by the microscope to be fragmentary particles of shell.

We owe to Professor Ehrenberg the separation of the remarkable group of *Rotifera* or Wheel Animalcules, from a lower division,—to which he has given the name of *Polygastrica*. On the complex structure and high organization of the Rotifera, all microscopists are agreed; not so, with respect to the Polygastrica. Many distinguished naturalists question the high authority of Professor Ehrenberg in this instance: and maintain that the facts which he has observed do not bear out his inferences, and that his account of the digestive apparatus of the Polygastrica is not entitled to rank as a physiological truth. Into this question we shall not now enter. But it is right to state our conviction, that Professor Ehrenberg has included among his Animalcules many forms which are truly vegetable, and whose supposed polygastric structure is altogether a product of his imagination. The beautiful tribe of *Desmideæ*, which forms the subject of Mr. Ralfs's admirable monograph, is now almost universally admitted, in this country at least, to be of a vegetable nature: and the recent discovery by Mr. G. H. K. Thwaites of the *conjugation* of the *Diatomeæ* makes it next to certain that this group, to which a very large proportion of the silicious fossil animalcules (so called) belongs, must be transferred in the same manner to the domain of the botanist. The phenomenon in question is one of a very singular character: and, as it is one of which the right understanding will probably lead to a remodelling of the whole fabric of Cryptogamic Botany, we shall endeavour shortly to explain it.

The attention recently paid to the simplest forms of vegetable existence has shown, what was previously suspected, that in the simple *cell* of the lowest Algæ we may find the type of all vegetative existence. This cell grows

from a germ, draws together the nutrient materials supplied by the surrounding air and moisture, combines them into new products, appropriates these products to itself by incorporating them with its own structure, multiplies its kind when it has itself attained maturity, and finally dies after performing all the functions of the most highly organized plants. And yet this cell is but a solitary *sacculus*, or minute bag, whose wall is composed of a transparent colourless membrane, whilst its cavity contains a fluid, in which are held a number of granular particles of a red or green hue, mingled with others that consist of starch. Of aggregations of such cells, each of them a distinct individual, the 'red snow,' the 'gory dew,' the 'green matter of Priestley,' and various other low forms of vegetation developing themselves in damp situations, are chiefly composed;—the cells being generally united by a gelatinous substance in which they are imbedded—but each one living for and by itself alone. Now, even in these insignificant tribes, we have the two modes of reproduction, as possessed by the higher plants, clearly sketched out. Whilst the cells continually multiply themselves by a system of *subdivision*, in which each splits as it were into two, an entirely new generation arises from the *approximation* of two cells, and the mingling of their contents. The immediate result is the formation of a *sporangium*, from which the new family is to spring, as the higher plant does from its *seed*. Now the process of multiplication, by the mere doubling of cells, is obviously analogous to the multiplication of the flowering plant by leaf-buds; the same that, in fact, takes place whenever there is a new growth in continuity with the old. But the act of conjugation, and the formation of the sporangium, represent the essence both of the flowering of the higher plants and of the ripening of the ovule. The fertilization of this consists (as we shall hereafter see) in the mixture of the contents of the two cells which are set apart for the purpose, and which differ from the conjugating cells of the lowest Cryptogamia in no particulars of importance.

The process of conjugation has long been known to take place in a certain genus of Confervæ, which received the name of *Zygnema* in consequence. But the phenomenon was considered exceptional until within a very recent

period. It has lately, however, been recognised among so many other tribes of the lower Algæ, that it must henceforth be looked upon rather as the rule. The fact that the origination of new generations proceeds from conjugation, or from the union of the cell-contents of two parent individuals, as well in the lowest Cryptogamia as in the highest flowering-plant, has obviously a most important physiological bearing—for it leads us to revert to the opinions of those naturalists who have maintained the existence of sexes in the Cryptogamia generally. At the same time it affords a valuable means of discrimination in regard to such ambiguous forms as the *Desmideæ* and *Diatomeæ*, whose animal or vegetable nature may be probably determined by this test more satisfactorily than by any other; nothing that truly resembles the conjugation of plants having been yet seen in any tribe of an undoubtedly animal character.

The careful study of these simple forms of vegetation has also led to the discovery that *active movements*, strongly resembling those of many animalcules, are performed by bodies whose vegetable character is undeniably proved by the nature of the structures into which they are subsequently developed; in which fact we have the explanation of the strange doctrine of former microscopists, who taught that there are beings which are *animals* in the earlier stage of their existence, and *plants* in the later. These movements depend on the same agency as those of many lower animals, namely, on the vibration of little hair-like filaments, termed *cilia*, from their resemblance to eyelashes. The *cilia* first strike the water with a broad surface, like that of an oar; whilst, in returning to their original position, they present a feather-edge to the liquid, and thus propel with great energy the body to which they are attached. This ciliary movement however is not confined to animalcules. By means of it the oyster, though it does not itself move, yet creates a current in the surrounding water—bringing food to its mouth, and oxygen to its gills. In higher animals it covers many of the membranous surfaces, especially those of the respiratory organs. Even in man there are incalculable numbers of such cilia constantly at work in his air-passages, which prevent the accumulation of the mucous secretions in the smaller tubes, and assist in carrying them away. This addition

to our knowledge of ciliary action has been chiefly the result of the systematic observations of Professors Purkinje, Valentin, and Sharpey, and was one of the earliest and most valuable fruits of the achromatization of the microscope.

That the red colour of the blood of the higher animals does not exist in the fluid, but only in certain particles which float in its current, was known to Leeuwenhoek, and perhaps to still older microscopists: and the forms of these particles were observed to vary in different classes of animals. It was not known until recently, however, that these floating particles are true *cells*, analogous to those of the simplest Algæ—each having an independent life of its own, whilst all are subservient to the life of the being through whose vessels they are carried—though in what precise way they are so has not yet been satisfactorily ascertained. It has been further proved by the researches of Mr. Gulliver, that there is not only a difference of *form*, but also of *size*, between the blood-discs of various animals; so that it is in many instances possible to distinguish with certainty between the blood of two animals belonging even to the same natural group. The contrast in size is very strongly marked in particular cases. While the diameter of the circular Human blood-disc averages something less than one three-thousandth part of an inch, that of the circular blood-disc of the Musk-deer is no more than one twelve-thousandth; and the large oval blood-disc of the Proteus measures nearly as much as one three-hundredth of an inch in length, and half that amount across its short diameter. It is a very remarkable fact that all the animals yet known, which agree with the Proteus in the retention of the gills after the lungs are developed,—remaining, in fact, all their lives in the condition of great tadpoles,—agree with it also in possessing blood-discs of unusual size. The fact that this character is presented by the blood-discs of the Lepidosiren, has been regarded as of no mean importance in discussing the real affinities of that curious reptile-like fish, or fish-like reptile.

We shall afterwards advert to the microscopic analysis recently made of those various soft tissues of animals and plants, which are the immediate instruments of their vital operations, and on whose nature any general expression of

the phenomena of life must be founded. But it is more convenient to consider previously the structure of the hard parts of animals, such as bones, teeth, shell, &c.; which present features of great interest, not merely to the physiologist who concerns himself about the vital phenomena of beings now alive, but also to the geologist who seeks in the fragmentary remains of past generations for materials to aid him in constructing a history of the earth. Of the organization of *bone*, nothing more can be made out by the naked eye, or through the help of ordinary magnifiers, than that the solid substance of its densest portions is traversed by a series of canals, which carry inwards the blood-vessels distributed over the investing membrane (the periosteum); and that the spongy texture, found in the ends of the long bones and between the superficial layers of the thicker flat bones, derives its character from the presence of a vast number of minute chambers, or *cancelli*, which are separated from each other by irregular and incomplete partitions, and into which also the nutritious vessels are prolonged. Nothing whatever was known of the structure of the bony matter itself; and no one could have even ventured to imagine the elaborate minuteness of its organization. But when a thin section even of the very densest bone is examined by a microscope of sufficient power, the solid substance is seen to be penetrated by innumerable tubuli of extreme minuteness, radiating from a series of isolated excavations, of tolerably regular shape and size, and so interlacing each other as to open a communication among all the neighbouring cavities. To compare small things with great, let our readers conceive themselves in a cavern excavated in the centre of a vast mountain, with no principal entrance, but hundreds of narrow passages piercing its solid walls. Whichsoever of these they follow, it will conduct them, after many windings, into a cavern similar to that which they had left; and after passing through a long series of such passages and caverns, they will at last emerge into open day. Such, on a scale almost inconceivably minute, is the structure of solid bone. Let us reduce the spacious cavern to an excavation of 1·1500th of an inch in length, and 1·5000th of an inch in breadth; and let the passages be contracted from dimensions sufficient to admit of our

entrance to a diameter of 1·20,000th of an inch (which is further diminished in the smallest branches to 1·60,000th of an inch), and we then shall have some idea of the wonderful contrivance with which this solid and apparently impervious substance is channelled out, like a coal-field by the miner. There cannot be a doubt but that this curious organization is in some way subservient to the nutrition of bone. The tubuli are far too minute to allow of the entrance of the blood as a whole; its floating particles, indeed, being nearly as large as the caverns themselves. But the great regularity of their arrangement, which is always adapted to keep up a communication between the interior of the bone and the nearest point to which blood is conveyed, seems to justify the inference that they take up from the circulating current, and distribute through the texture, such portions of the fluid as the bones require for their maintenance and consolidation. Very thin bones are nourished by blood, which is simply distributed over their surface; but larger and thicker bones are traversed by passages, into which the vessels penetrate.

We are too conscious of the difficulty of conveying by words alone a distinct idea of so complex a structure, to venture to be sure that we have carried with us every one of our readers through the preceding description. We trust, however, that we have fully impressed them with the wonderful elaborateness displayed in the minute structure of bone. This elaborateness has no parallel in any of the hard tissues of which the skeletons of invertebrated animals are composed. And it seems designed, on the one hand, to minister to the continual changes which bone must undergo during the period of its growth, and, on the other, to confer upon bone that power of self-reparation which it so remarkably displays after disease or injury. It is interesting to observe that whilst, as in the case of the blood-corpuscles, there is no relation whatever between the size of the animal and the dimensions of the elementary parts of its bony skeleton,—the length of the cavernules and the diameter of the tubuli being nearly the same in the Elephant and in the Mouse, in the gigantic extinct Iguanodon and in the smallest existing Lizard,—there is yet a marked difference in these particulars between ani-

mals of different zoological groups. Thus the cavernules of Reptilian bones are distinguishable from those of Birds and Mammals by their great length in proportion to their breadth; and those of Fish may be usually recognised by their angular form, and by the small number of their radiating tubules. In certain species of the last-named class, however, there is an approach to reptiles, in general conformation; the minute structure of the bones also exhibits the same transitional character. The cavernules of the bones of Birds and of Mammals do not differ considerably in size: but there are diversities in the origin and course of the radiating tubules, which usually render it very easy to distinguish them. For our knowledge of these diversities we have principally to thank Mr. Quekett and Mr. Bowerbank. We will now adduce an example or two of their applicability as distinctive characters, both in zoology and palæontology.

We have already noticed the position of the *Lepidosiren* as one of the most interesting questions at present under discussion among naturalists; and have adverted to the large size of its blood-corpuscles, as significant evidence towards determining its real place in the scale. We may now add, that in the minute structure of its bones, its relationship to the perenni-branchiate reptiles, rather than to fish, is no less decided,—the form and size of the cavernules, and the distribution of the tubuli, corresponding closely with what is seen among the former, there being nothing parallel in the latter class.

In the determination of the real nature of fossil bones, whose imperfect preservation or whose insufficient characters render their recognition difficult and uncertain, the value of the microscope has been no less satisfactorily established. Dr. Falconer, the distinguished investigator of Himalayan palæontology, having met with certain small bones, about which he was doubtful, placed them in the hands of Mr. Quekett for minute examination, and was informed, on the authority of the microscopic test, that they might certainly be pronounced reptilian, and probably belonged to an animal of the turtle tribe. They subsequently proved to be the toe-bones of the *Colossochelys Atlas*, the gigantic fossil tortoise, nearly twenty feet in length, discovered by Dr. Falconer in the Sivalik region.

The test has been applied, with equal success, by Mr. Bowerbank to the determination of some doubtful wing-bones found in the chalk near Maidstone. The question of their ownership lay between the long-winged sea-birds, such as the Albatross, and the ancient Pterodactyles, or winged lizards. The evidence from external form inclined somewhat in favour of the former; and, as no Pterodactyle of a greater spread of wing than five or six feet had been previously known, it was thought an additional proof of the ornithic character of these bones, that they must have belonged to an animal whose wings measured at least eleven feet, when fully extended. But the minute structure of the bones of undoubted Pterodactyles is decidedly characteristic of their reptilian nature; and they have additional well-marked peculiarities, such as have not yet been found in any other animal. The fact, therefore, that a complete identity of structure has been ascertained to exist between the bones of the Maidstone fossil, and those of the genuine Pterodactyle, appears to us to settle the question of the real nature of the former. The structure in question is as unlike that of any bird, as it is accordant with that of this peculiar reptile. And the *essential* characters furnished by the minutiæ of organization, are now universally admitted by competent judges to possess a higher value than those *adaptive* characters drawn from external configuration, which have reference only to the purposes of the organ. It is true, we must extend our ideas of the dimensions of the flying reptiles, which took the place of birds in the atmosphere of the ancient world. But this will not be a real difficulty in the apprehension of any one at all conversant with the other gigantic forms of reptilian life now extinct. Some future palæontologist, whose first ideas of the marine birds of our epoch had been formed upon the fossil remains of a Gull, might, with equal reason, object to the idea that a bird, of the dimensions of an Albatross, ever soared over our ocean. We cannot doubt but that the general application of this test will prove most advantageous in the determination of the true nature of fossil bones, whose external characters are ambiguous; and we may hope thus to see the termination of those conflicting statements, which have in so many instances obscured the truth, and led to acrimonious discussion.

The researches of the microscope into the organic structure of *teeth* have been equally successful; not only for the purposes of the physiologist, but, most unexpectedly, for those also of the zoologist and palæontologist; scarcely any means for determining affinities and recognising imperfect fossil remains being so precise and certain as the minute diversities in teeth. The real structure of teeth was first noticed by Leeuwenhoek. In the Philosophical Transactions of 1678, he described the human tooth as 'made up of very small, straight, and transparent pipes,' and in a subsequent paper he calculated that the number of these 'pipes' in a single molar amounted to nearly *five millions*. He spoke, also, of their existence in the cod and in the haddock. But these observations were so completely overlooked by later writers, that the controverted question, whether teeth possessed an organic structure, was very generally decided in the negative until a recent period. Teeth were considered, in fact, as mere stony exudations from the surface of the tooth-pulps, and so far assimilated to shell. The achromatic microscope, however, had not been long in the hands of anatomists, before the investigation of the structure and development of teeth was taken up anew, under more favourable circumstances; and there is, probably, no single branch of microscopic inquiry which has been, or which is likely to prove, so fertile in valuable results. Into the troubled question of priority we have no desire now to enter; but, content with expressing our obligations to Purkinje, Retzius, Müller, and Agassiz, among continental anatomists, and to Owen, Nasmyth, and Tomes, among our countrymen, we shall proceed with our endeavour to convey a general idea of their labours.

The greater part of the substance of the teeth in the higher vertebrata, and the whole of it in the lower, consists of the substance commonly termed *ivory*, but which has been more appropriately termed *dentine;* meaning by the word 'dentine,' what is essential to the composition of the dental structure, and restricting the word 'ivory' to certain varieties of the substance. Dentine, like bone, is made up of an apparently homogeneous substance, composed of animal and mineral matter in intimate union. Like bone, too, it is channelled-out by innumerable pas-

sages of extreme minuteness, which, though incapable of admitting blood, seem to convey the nutriment absorbed from it. There is no system of cavernous excavations, however, in true dentine; the tubuli passing continuously onwards, instead of merely traversing the spaces between successive chambers as in bone. In human teeth, and in others whose dental structure is equally simple, the tubules originate from the central pulp-cavity, and radiate outwards with great regularity; their course being slightly sinuous, but having a constant direction towards the exterior of the tooth. The diameter of their calibre near their central commencement does not exceed 1·10,000th of an inch; and this gradually diminishes, as the tubuli pass outwards, and send off lateral branches, until it is reduced at their terminations to the smallest channel that can be distinctly traced through the solid substance. In the teeth, however, of many animals, there is no single central pulp-cavity, but the whole substance is excavated by vascular canals, very analogous to those of bone. We find, in such cases, each canal the centre of a system of radiating tubuli, so that the transverse section of the tooth strongly resembles that of bone, except in the absence of the cavernules. This type of structure prevails chiefly among fishes: and it is a curious fact, that in this group, the lowest in which true bones and teeth are found, the characters of the two structures should approximate so much more closely than in the higher classes, where both are elaborated, each in its own fashion, until they become distinct. In other instances, again, where a central pulp-cavity does exist, it sends vascular prolongations for a certain distance into the dentine: the outer layers of this substance, however, are very seldom thus penetrated by blood-vessels.

The dentine is capped, in the human tooth, by a layer of a harder substance, familiarly known as *enamel*. This is the hardest of all the animal tissues; and is indeed so completely mineralised, that the organic basis does not form above two or three per cent. of its components; yet it presents a very distinct organic structure. It is composed of a series of prismatic membranous *cells* (resembling those of a honey-comb in miniature) arranged side by side with great regularity. Their lower extremities

rest upon the surface of the dentine, whilst their upper ends form the crown of the tooth; and the extraordinary density of the tissue appears to be occasioned by a deposit of calcareous matter, with which the cells are completely filled, and in which phosphate of lime predominates. The strength of these enamel-prisms is increased by the wavy curves in which they are arranged. By this means their alliance is much more dependent and complete, than if each of them were a straight column supporting its own separate share of pressure. The disposition of the enamel varies greatly in different tribes of Mammalia, according to the purposes to which the teeth are to be applied. Thus in the long front teeth of the Rodents, we find it only upon the front surface, where, owing to its superior density, it constantly projects beyond the ivory, and maintains a sharp cutting edge, however much the tooth may be worn down. In the herbivorous Mammals, the surface of the grinding teeth is merely penetrated by vertical plates of enamel, instead of being covered with a continuous layer: and their superior density and resistance are the cause of those ridged inequalities of the grinding surface, which enable them to triturate their tough vegetable food. In Sloths and other edentate Mammals, the enamel is altogether wanting.

A third substance, the 'cementum' or 'crusta petrosa,' has long been known as a constituent of the teeth of herbivorous animals; but it is only lately, by means of the microscope, that its existence in human teeth has been detected. The intimate structure of the 'cementum' is the same with that of bone. It has the same system of cavernules and tubuli communicating with the nearest vascular surface; and its thick layers, whenever they exist, are penetrated by vascular canals. As it invests the fang of the tooth, it forms a bond of vital union between the denser structures of the tooth itself, and the bone in which it is implanted. In herbivorous Mammals, on the contrary, it penetrates, like the enamel, the substance of the grinding teeth; the vertical folds in which it is arranged, being softer than the dentine, are most rapidly worn down; and the inequality produced by the superior density, and consequently slower abrasion, of the enamel, is considerably increased.

Such being the structure of teeth and their three component parts, it is evident from our verbal sketch, that they deserve a far higher character than that of mere inorganic exudations. Without entering into the history of their development, by the consolidation of the soft tissues forming the *pulp* of the tooth, the knowledge of the fact is of the utmost importance in interpreting the phenomena of disease, and has already led to great improvements in dental surgery.

The varieties of dental structure produced by differences in the arrangement and relative amount of these three components are in themselves very numerous; and they are vastly increased through the diversities exhibited by the minuter characters of each tissue. To some of these we have already alluded; and instead of formally detailing others, we will adduce a few examples, by way of proof, of the assistance which microscopic research has already rendered to the Naturalist.

There have been few questions in palæontology more fruitful of discussion, than that of the precise zoological affinities and habits of life of the great extinct Megatheroid quadrupeds of South America. They present the strange phenomenon of a skeleton more closely resembling that of the sloths than any other; not merely expanded to a colossal size, but developed with a massiveness unparalleled in any other animals of similar dimensions. The feet, on the other hand, were constructed rather upon the plan of those of the ant-eaters and armadilloes; being obviously capable, in virtue of their long, curved, sharp-edged claws, of being used as efficient instruments for digging or excavating the soil. In consideration of these peculiarities of conformation, as long as attention was not paid to the characters furnished by the teeth, an opinion was entertained by many distinguished palæontologists, that these strange beasts must have burrowed in the ground, like the pigmy armadilloes of the present time, and have fed upon the roots which they there met with. From the examination of the minute structure of their teeth, however, ample evidence was obtained by Professor Owen, that the food of the Megatheroids must have been of the same description with that of the existing sloths; that is, it must have consisted of vegetable matter capable of being easily reduced

to a pulpy state, such as the leaves and young shoots of trees: for the teeth are entirely destitute of enamel; without which it is impossible that tough fibrous roots could be ground down. The greater part of their substance is made up of coarse vascular dentine; the exterior being composed of vascular cementum, and the harder non-vascular dentine forming only a hollow cylinder between the two. The conformation of the skeleton having been re-investigated by Professor Owen under the guidance of this most important indication, he succeeded in obtaining a most satisfactory solution to the problem of their mode of existence. They prove to be Sloths in all their essential characters—but adapted to live upon the ground, instead of climbing trees; which could not have sustained their enormous weight, even had it been possible to endow them with the climbing power. Not only were their limbs expanded to a colossal bulk, but, from its size and strength, their tail also was obviously designed for an organ of support; forming a firm tripod with the hind legs. Upon this tripod we may conceive the gigantic Mylodon or Megatherium to have reared itself, after having excavated with its trenchant claws the earth around the roots of the trees on whose leaves its hungry eyes were fixed; thus, raising itself upright, and placing its fore-feet against the trunk, it would sway the tree to and fro, until it had brought it down, and so provided itself in its foliage and tender shoots with a supply of food.

The 'Odontography' of Professor Owen will afford us another example of the value of the microscope in determining the nature of a doubtful fossil. This work contains the results of the laborious and accurate observations of its distinguished author upon almost every principal tribe of the three classes of vertebrata in which teeth are present; and must constitute the foundation of all future researches on this subject. In the case in question, a few scattered teeth were almost the only indications of animal life throughout an extensive stratum: and they happened not to be characterised by any peculiarity of external form—so that their real nature would have remained doubtful, unless the microscope had enlightened us on their internal structure. Some years ago, certain detached teeth were found in the keuper-sandstone of Wirtemberg, and were described

by Professor Jaeger as the remains of a gigantic Saurian reptile, to which he gave the name of Mastodonsaurus. Other fossil fragments of jaws and teeth from the same formation were described under the name of Phytosaurus. A third remarkable and characteristic fossil discovered in the keuper-sandstone, consisted of a fragment of a cranium having certain peculiarities of the Batrachian reptiles; and on this fossil Professor Jaeger founded his species called 'Salamandroides giganteus.' In a sandstone deposit in Warwickshire again, certain teeth or fragments of teeth, at first supposed to be of saurian character, had also been discovered. Whether this sandstone was the equivalent of the keuper or of the bunter division of the new red standstone formation, as developed in Germany, was an important question. Accordingly, it became also of importance to determine whether the Wirtemberg and the Warwickshire fossil teeth were of identical or of allied species, or whether they were altogether dissimilar. Now the external forms of the teeth of reptiles are seldom so characteristic as in Mammals, whose teeth are much more adapted to their several kinds of food. It is not at all surprising, therefore, that Professor Owen was unable to pronounce upon this question, from the comparison of their external aspect alone. But, on procuring a thin section of one of the Wirtemberg teeth, and placing it under the microscope, a most wonderful and complicated structure presented itself to his astonished view. Of this structure we almost despair of conveying an idea by words alone. We will, however, try with the assistance of some of the forms which connect it with the ordinary types of dental structure. Our readers must first picture to themselves a hollow cylinder of dentine, covered externally by cementum, and enclosing the soft pulp of the tooth; and then imagine the cylindrical wall to be thrown into a regular series of wavy folds arranged vertically: they will thus understand the formation of the lower part of the tooth of the extinct Icthyosaurus—and also that of the tooth of the Lepidosteus or Bony Pike, one of the few sauroid fish still existing. But let them further suppose these folds to be deepened, so as to become a series of plaits, all directed towards the axis of the cylinder, and in contact with each other at their sides; and afterwards, suppose

the plaits themselves to be thrown into secondary folds and convolutions, so as to present very much the aspect of the surface of the brain; they will then have some idea of the extraordinary structure of this tooth, the original possessor of which has since received the very expressive designation of *Labyrinthodon*, the former name of Mastodonsaurus being no longer appropriate. It was only after making sundry sections of this tooth in various directions, and frequently comparing them with numerous examples of the teeth of Saurians, Batrachians, and other animals, that Professor Owen at length comprehended the cerebriform convolutions by which every portion of the tooth of this most singular reptile of the keuper-sandstone is so remarkably distinguished. Once fully comprehended, however, all this complexity was found to be apparent only: for each wavy fold has on one side of it an extension of the central pulp-cavity, from which its dentinal tubes proceed; whilst its other border properly forms part of the external surface of the tooth, carried in by this extraordinary duplication towards its centre, and thus everywhere in its usual relation with the cemental layer.

The next step was, of course, to make a similar examination of the teeth from the Warwickshire sandstone. The result left no doubt but that they belonged to the same genus with the German specimens; and this, in connection with other evidence, sufficiently proved the equivalence of the German and English deposits. A most interesting zoological problem now came under consideration;—what was the nature of the animal to which these teeth belonged? They had been referred, from *external* characters, to the Saurian order; but these characters were by no means conclusive, owing to the general similarity of form which prevails through that entire class. As the nearest approaches to the peculiar *internal* structure of the teeth are presented by Fish-lizards, and Lizard-like fish, it might be reasonably expected that the Labyrinthodon would combine with its reptilian characters an affinity with fish. This turned out to be the case on an examination of the fragments of *the skull* of the Warwickshire fossils, with which the teeth remained in connection; and the analogy was confirmed by comparing them with the Batrachian remains in the keuper-sandstone. All things considered,

there can be no question, we think, but that the Labyrinthodon was in reality a gigantic Batrachian or frog-like animal, five or six feet in length, with some peculiar affinities to fishes, and a certain mixture also of Crocodilian characters.

Now, it happens that, in various localities, where beds of the new red-sandstone formation have been exposed, and especially in the Stourton quarries, near Liverpool, *foot-prints* are found, which afford unmistakeable evidence of the former existence of an air-breathing animal, whose posterior extremities must have been of most disproportionate size, and its foot of a singular hand-like shape. The provisional name of *Cheirotherium* had been bestowed upon this unknown quadruped, and more than one palæontologist suggested that the creature must have been a Batrachian reptile. But it was objected that the gigantic dimensions of the hypothetical frog were without a precedent; and that its feet were unlike those of any existing Batrachian, or, indeed, of any reptile whatever. We have now seen, however, that in beds of the very same formation, there have been found the teeth and bones of a gigantic Batrachian reptile, whose dimensions and proportions would agree with the foot-prints in question; and which differs from all other Batrachia,—indeed from all other reptiles,—in the structure of its teeth, and therefore (it may fairly be inferred) also in the structure of its extremities. It appears to us, therefore, that a very satisfactory case is made out by Professor Owen in favour of the identity of the *Labyrinthodon* and the *Cheirotherium*; and we cite it, for the purpose of observing that the most important link in the chain of evidence was furnished by microscopic examination of the teeth.

Though we have dwelt so long upon this example, before leaving it we wish to notice a curious fact connected with it. Very shortly after the publication of the second part of Professor Owen's Odontography, containing his beautiful delineations of the dental structure of this fossil, a pocket-handkerchief was made in Manchester, with an enlarged copy of the section of the Labyrinthodon tooth for its pattern! It would be well, we think, if our manufacturers had recourse more frequently to Nature for suggestions. The sections of the spines of the Echinus, whose remarkable

structure we shall presently notice, would supply a vast variety of patterns of wonderful delicacy and beauty, both of form and colour.

We will instance only another application of the microscope to this branch of inquiry, in a recent example of great interest to economy as well as science. A continuous rock-formation extends over many parts of Russia, bearing a strong resemblance in its mineral characters to members of the Permian and Triassic systems,—the magnesian limestone and new red-sandstone of our own country. But so great was the difficulty of obtaining from stratification any evidence of its proper place in the series, on account of the prevalent horizontality of the strata, that the only hope of settling the question rested upon the organic remains which might be discovered in the formation. Unfortunately these were few and fragmentary,—consisting chiefly of teeth which are seldom perfectly preserved. From the gigantic size of these teeth, together with their form, it was at first inferred that they belonged to Saurians. But the microscopic investigations of Professors Asmus (of Dorpat), Agassiz, and Owen, have proved them to be the teeth of gigantic fishes, and to belong to a genus (*Dendrodus*) whose presence is restricted to the Palæozoic formations. The deposit in question is therefore a representative of the *old*, not of the *new*, red-sandstone,—a determination of the greatest practical moment; for, on the former supposition, that the teeth were the remains of Saurians, coal-measures would have been expected to lie below; and extensive borings might have been carried on, involving great expenses. The discovery that the remains belonged to fishes of the Devonian epoch put an end to all such expectations.

The line of inquiry which was opened by these and similar discoveries has been successfully followed up by Dr. Carpenter. He has demonstrated the organic structure of the *shells* and other external skeletons of invertebrated animals; and has shown that the diversities are, in many instances, sufficiently definite in their characters to determine the family, sometimes the genus, and occasionally even the species—from the inspection of a minute fragment of the shell, fossil as well as recent. The most recent conchological writers had been of opinion, on the contrary, that shell was not merely destitute of blood-ves-

sels, but was completely *inorganic*,—composed, in fact, of an exudation of calcareous particles, cemented together by animal glue. Even the celebrated geologist and palæontologist Von Buch, when first informed of the result of these observations, exclaimed that it was 'impossible' that shells should possess any organic structure. An *a priori* probability, however, in favour of their possessing a certain degree of organization followed the discovery of the organic structure of the epidermis or cuticle of higher animals; and the progressive elevation of physiology as a science, which now enables it to *predict* phenomena, as well as to record and generalise them, is well illustrated by the fact that Dr. Carpenter had published in 1841, some time before the commencement of his direct investigations, the following anticipation of their results: "From the analogy which the shells of Mollusca and Crustacea bear to the epidermic appendages of higher animals, there would seem reason to believe that the former, like the latter, have their origin in cells, and that these are afterwards hardened by the deposition of earthy matter in their interior."*

Indeed, the shells of Mollusca may be regarded as strictly *epidermic* in their character; since they are formed upon the surface of the *mantle*, which answers to the true skin of other animals. They appear to be always composed, in the first instance, of epidermic cells, consolidated by the deposit of carbonate of lime in their interior; and in many cases such is the structure, distinctly exhibited in the fully formed shell, and visible in the membranous residuum, after the removal of the calcareous matter by dilute acids. It often happens, however, that the original cellular organization is obscured through subsequent changes, by which new forms of tissue are produced; and we sometimes lose all traces of it. Certain shells have a very elaborate *tubular* structure; the tubes being disposed in an irregular network near the internal surface, with which they appear to communicate, and sending off long straight branches at intervals which pass towards the exterior. These tubes are usually much larger than those of teeth and bone—their diameter being frequently as much as 1·4000th of an inch. Still it does not appear probable that they receive blood;

* Principles of General and Comparative Physiology, 2nd edit. p. 33.

though they may be well supposed to imbibe nutritious fluid from the surface of the mantle for the reparation of the exterior of the shell; more especially as most of the species in which they abound are remarkable for their foliated or sculptured surface. The peculiar group of bivalves, known under the designation of *Brachiopoda*, is of the greatest interest to the palæontologist. Their proportion to the ordinary bivalves is at present quite insignificant; but it includes nearly all the bivalve shells which were most abundant in the earlier part of the Palæozoic series. A most unexpected structure has lately been discovered in them. Not only is the texture of the shell itself so peculiar, that almost any species may be recognised as a Brachiopod, from the microscopic examination of even a minute fragment; but in a considerable section of the group, the soft organs of the animal within are seen to be actually prolonged into the substance of the shell, passing though it to its external surface.

The real structure of *nacre*, or mother-of-pearl, to which its iridescence is owing, has also been determined by a similar method of inquiry. The peculiar lustre of this substance was long since discovered by Sir D. Brewster to be due to the striation of its surface by a series of very shallow grooved lines, which usually ran parallel to each other; and it was found that impressions taken from it on sealing-wax, gum, or any other similar material, would exhibit the iridescent colours. Many of our readers are doubtless familiar with the fact, that it has been found possible to communicate similar prismatic hues to metallic surfaces, by ruling them with lines by means of a diamond point, at the distance of 1·10,000th of an inch from one another. Indeed, if such lines be ruled upon a die of hardened steel, the iridescence is developed in every metallic surface which receives its impress. As the lines upon nacre are not obliterated by any amount of polishing, it is evident that their presence depends upon something peculiar in the intimate texture of this substance, and not upon any merely superficial arrangement. Sir D. Brewster supposed this peculiarity to consist in an alternation of layers of mineral membrane and calcareous matter,—the grooves being produced by the wearing away of the former. Now, supposing every line upon the nacreous surface to indicate a distinct

layer of shell substance, a very thin section of mother-of-pearl ought to contain many thousand laminæ, in accordance with the number of lines upon its surface. But what is the fact? When the calcareous portion of the nacre is dissolved with dilute acid, no such repetition of membranous layers is to be found. On the contrary, if the piece of nacre be the product of one act of shell-formation, it furnishes but a single layer of membrane. In the investigation of this curious problem, Dr. Carpenter availed himself of the peculiar facilities afforded by the well-known *Haliotis splendens*, the remarkable variety of hues in whose shell is produced by the alternation of layers of nacre with laminæ of a horny substance like tortoise-shell. And he was thus led to the discovery that the iridescence may continue in the *membrane alone*, after all the calcareous matter has been removed by acid,—provided that this membrane retain the folds or plaits in which it was originally disposed, and to which the lineation of the nacre is evidently due. On the other hand, if the membrane be extended, so as to obliterate the folds, its prismatic lustre entirely disappears. The conclusion is, a complete confirmation of Sir D. Brewster's optical discovery of the dependence of the iridescence upon the lineation of the surface, and at the same time a correction of his explanation of the cause of it.

As in the case of bones and teeth, the peculiarities of intimate structure displayed by many shells have enabled the microscopist to identify even minute fragments, which had nothing characteristic in their external forms. For instance, there are certain tribes, both recent and fossil, whose other characters leave a doubt respecting their true place in the series—such as the curious extinct group of *Rudistes*—where the results of a similar examination appear to furnish the decisive evidence required.

The shells of *Crustacea* are shown by the microscope to be even more highly organised than those of Mollusca. A section taken across the black end of the claw of the common crab exhibits a structure exactly resembling that of dentine; the dense homogeneous substance being traversed by a multitude of tubuli radiating from the central cavity towards the circumference. The same structure is found in other parts of the shell, but the texture is less dense;

the extremity of the claw obviously requiring, for its prehensile purposes, a special degree of firmness. The surface of the shell is covered by a layer of flattened cells, fitted to each other by angular borders, so as to form a continuous layer. These cells have the power of secreting colouring matter; and it is from the secretions which they elaborate, that the hue of the surface, with all its variations, is derived.

The minute structure of the skeleton in the class of *Echinodermata* presents features of peculiar interest. This class includes, not merely the *Echinus* (sea-urchin) and *Star-fish*,—its best known forms,—but also the *Holothuriæ* (sea-cucumbers), and the vast group of *Crinoidea*, which are scarcely at all represented at the present epoch. The forms and conditions of these animals have apparently nothing in them common to all. What is the similarity, for example, between the zoophytic *Encrinite*,—an animal somewhat resembling a star-fish, but attached by a stony stalk to one fixed point during its whole existence,—and the free-moving, soft-bodied *Holothuriæ*, which, as their vernacular name implies, are sometimes so elongated as to present an entirely worm-like aspect, and in which we frequently lose all trace of the radial symmetry by which the group, as a whole, is characterised? Notwithstanding this apparent absence of a community of nature between the extremes, the groups in question are united by such a continuous series of intermediate forms, that no naturalist has felt any hesitation in placing them together in the same class. To this class, however, it has been hitherto impossible to assign any precise general character. The character conveyed by the designation *Echinodermata* (prickle-skinned) is of very limited application. For the prickles or spines which cover the surface of the Echini and the like, are scarcely developed in the star-fish, and are entirely wanting in others. By some naturalists the possession of *cirrhi* or tendril-like tubes proceeding from the skin has been thought to approach most nearly to a criterion of the class. But Dr. Carpenter has pointed out a more extensive agreement in the minute structure of the skeleton,—whether it consists of polygonal plates united at their edges so as to form a complete envelope to the body, as in the *Echinus*,—or of a solid stem and branching arms, as in the *Crinoidea*,—or of a jointed flexible framework within a

thick skin, as in the *Star-fish*,—or is only to be discovered in the rudimentary condition of scattered patches of calcareous deposit, as in the *Holothuria* and its allies.

The elementary structure of the skeleton in this class may be described as a *network*, composed of calcareous and animal matter intimately united; the former, however, being greatly predominant. In this network, the interspaces or openings, and the solid structure which surrounds them, may bear an extremely variable proportion to one another. The predominance of the latter gives great solidity and strength to those parts of the skeleton where strength is principally required; whilst the texture is very loose and porous, with but a small amount of solid materials, in those parts where the object is rather to fill up space. In either case, however, the strength of the whole is much greater than would be inferred from the apparent slightness of its intimate structure, as seen in a thin section. For the network is not on a single plane, but extends in all directions, every part supporting every other part, and being supported by it in turn.

But this structure is seen to most advantage in the *spines* or prickles, with which the shell of the Echinus is beset. The strength of these organs is so increased by being connected with solid ribs or pillars, as to constitute a regular and distinct pattern, which appears to differ in every separate species. The spines are, for the most part, cylindrical or conical in their form; their transverse sections, therefore, are usually of a circular shape. Reduced to a sufficient thinness, and examined with the microscope, they exhibit a regular concentric arrangement, resembling that of an Exogenous stem, and proceeding from the same cause —the addition of successive layers, each on the outside of the preceding one. Each layer of the calcareous network is surrounded by a row of solid pillars or ribs, which may be seen running from end to end on the external surface of the spine; and as these are composed of a very transparent substance, their cross-sections might be mistaken at first sight for open spaces, in those species at least in which the substance is colourless. In most cases, however, it is tinged with some decided hue. The brilliancy of these hues, when shown in a strong light, and the marvellous regularity and variety of the pattern, render these sections,

unattractive and even uncouth in external appearance as are the bodies from which they are derived, perhaps the most beautiful objects which the microscope has revealed to us. As much of beauty is found in the infinity of shapes and hues, as of exquisite fitness and harmony in the forms and structures of the new creation thus brought within our survey.

We have already alluded to the importance of the microscope to the geologist; how it has verified the true nature of fragmentary remains of the animals and plants of former epochs, and how it has shown us vast stratified deposits almost entirely made up of the accumulated remains of animals and plants which, even in their living state, were of microscopic minuteness. We still look forward to further discoveries in other cases, from a microscopic examination of rocks, at present believed to be inorganic. At the request of Mr. C. Darwin, Dr. Carpenter minutely examined the physical composition of the extensive calcareous deposit which covers the surface of the Pampas, and in which the remains of the great Megatheroid quadrupeds are imbedded; and compared it with the composition of the calcareous tufa now in progress of formation along the coast of Chili. The latter was found to be obviously composed in great part of fragments of shells, distinguishable by the naked eye: and the dense matrix in which they are imbedded is chiefly made up of minuter fragments, only distinguishable as such by the microscope; while the amorphous deposit of calcareous particles that cements the whole together has every appearance of having been the result of the attrition or decomposition of the same organic structures. On examining the Pampas deposit, the principal part of it was found to be composed of amorphous particles, so similar in aspect to those of the Chilian rock that their identity could scarcely be doubted; whilst, scattered at wide intervals, were discovered particles of shell, distinctly recognisable by the microscope, though invisible to the naked eye. From these indications it seems a probable inference that the sources of both deposits were the same; but that the materials of the Pampas deposit had undergone a much greater degree of comminution than those of the Chilian rock. This inference agrees with Mr. Darwin's hypothesis, "that the Pampean formation was slowly ac-

cumulated at the mouth of the former estuary of the Plata, and in the sea adjoining it;" and appears to render it much more probable than M. D'Orbigny's theory of a great debacle, or Sir Woodbine Parish's idea of a fluviatile deposit.*

We observe also in Mr. Williamson's microscopic analysis of the Levant mud, already alluded to, that he has been able to recognise minute fragments of the shells of Mollusca and Echinodermata, mingled with the Infusoria and Foraminifera, of which that deposit is chiefly composed; and it further appears, that fragments of this description form no inconsiderable proportion of some varieties of chalk. Dr. Carpenter's attention has recently been given to the minute examination of those vast deposits of Nummulitic Limestone in different parts of the world, which have been represented by many geologists as equivalent to the higher beds of chalk of Northern Europe; but which are now generally regarded as belonging to the earliest ages of the tertiary period. In a paper on this subject recently communicated to the Geological Society, Dr. Carpenter has not only described an entirely new type of structure, presented by bodies which have been hitherto, for want of microscopic analysis, classed among the Nummulites; but he has also proved that the calcareous matrix in which the Nummulites and their allies are imbedded, and which forms continuous strata of hundreds of miles in length and breadth, and sometimes of three thousand feet in thickness, is itself composed of the comminuted remains of similar bodies, mingled with the shells of minuter Foraminifera.

Similar illustrations of the importance of microscopic inquiry in adding to our knowledge of *details,* in every department of the science of organization, might be multiplied indefinitely. But the microscope has in fact wrought a complete revolution in the *general aspect* of the science; and we are desirous of laying before our readers a sketch of what may be termed the Philosophy of Physiology, as this fine instrument has now enabled us to understand it.

* Darwin's Geological Observations on South America, p. 77.

We have already pointed out how microscopic investigation has demonstrated, that the simplest form of a living independent structure is a solitary *cell;* and that this cell lives for and by itself—drawing its nourishment from the elements around, converting them into the materials of its own growth, multiplying itself by self-division, and originating an entirely new generation by the union of its contents with those of another cell of a similar kind. Now if we analyse the structure of the most complex and perfect plant, we shall find that it may be reduced to an assemblage of the same elements; among which the whole series of vital actions is distributed, in such a manner that each cell, whilst going through its own succession of changes, at the same time performs some office which is essential to the existence of its fellows, and which is thus subservient to the common life of the whole fabric. A great part of that fabric, in the long-lived forest tree, consists of a structure whose offices are rather mechanical than vital;—namely, the woody fibre, which constitutes the chief portion of the solid axis of the stem, roots, and branches; and which also enters the leaves and fruit, forming a skeleton for the support and protection of the softer parts. Yet this woody fibre is itself made up of lengthened cells, whose cavity is filled with a hard deposit, just in the same manner as the cells of shell are consolidated by carbonate of lime. We find, too, that the higher plants are provided with a set of vessels, for the rapid and uninterrupted conveyance of fluid from one part to another; while these vessels are themselves formed by the coalescence of cells arranged in a linear series, the partitions which originally separated them having disappeared.

Thus even in these two portions of the fabric, which seem to depart most widely from the simple type of vegetable life presented by the Cryptogamia, there is no real infraction of the general principle that the entire organism is composed of an assemblage of cells; and the modification has reference solely to the mechanical purposes to which these tissues are to be subservient. In those parts of it, however, in which active changes of a strictly *vital* nature are taking place, we uniformly find these operations effected by the instrumentality of cells, which retain their original simplicity and independence of character, and

which go through their term of life with comparative rapidity. Thus it is well known that the chief agent concerned in the first absorption of fluid through the roots, is neither the woody fibre which forms the principal mass of their fabric, nor the vessels they contain; but the succulent cellular tissue at the growing extremities of their ultimate ramifications. This fluid undergoes no essential change during its ascent to the leaves. But in these organs it is completely transformed,—a large part of its superfluous water being set free by exhalation, and its solid matter receiving great addition in the carbon fixed from the atmosphere. It is through this process of elaboration, effected by the cells of the leaves, that the crude watery fluid which is brought up to the leaves, is converted into the viscid descending sap, which now contains all the organic substances necessary for the extension of the fabric, as well as those numerous materials, known as vegetable secretions, so essential to animal life and human welfare. We usually find these products separated from the general current of the circulation, and stored up in some particular part of the fabric. Thus, the nutritious properties of the seeds of the grasses and leguminous plants, are derived from the combination of azotised compounds and starch: in other cases, the seeds are valuable on account of the quantity of fixed oil contained in them; essential oils, again, are usually kept apart in special receptacles, either in the seed-coats, or in the envelope of the fruit, or in the leaves; colouring matters, though sometimes obtained from the general mass of the soft tissue, are very commonly preserved in the wood, as also resinous compounds; while the medicinal properties of plants in their vast variety are discovered hidden, some in one part of the structure, some in another, but nearly all in particular situations appropriated to them. Now the cavities of *cells* are the storehouses of these several products; from every class of which a certain group of cells procures the peculiar nourishment required for its development.

In the higher plants the enlargement of their fabric, by the growth of new parts, is always effected by the production of new cells, in continuity with those previously existing, and in fact generated from them by the same process of multiplication as in the lowest forms of vegetation;—

the difference in the two cases being simply this,—that, whereas every cell among the latter possesses the same attributes, and is accordingly capable of sustaining its own existence, and of living independently of its fellows, the component cells in the higher plants are so diversely endowed, as to be mutually dependent upon each other. Thus the cells of the leaves will not grow, unless the due supply of fluid be imbibed by the cells of the roots; the secreting cells cannot separate their characteristic deposits, unless these have been already prepared by the elaborating agency of the leaves; and every fresh development, or growth, presupposes the due performance of their functions by all the organs which supply the requisite material.

In this manner the nutritive operations of plants, however varied their nature and complicated their relations, essentially consist of *cell-life;* the tendency of which is to build up and sustain a fabric to whose extent and duration no definite limit can be assigned. In the meantime it is observable that the growth of the more permanent substance of the structure is only attained by the continual development, decay, and renewal of other parts. The elaborating cells, which compose the soft tissue of the leaves, are a striking proof of this. They obviously have a fixed and definite term of life, during which their powers are exerted for the benefit of the remainder of the plant; and when this has been accomplished, they die and are cast off. The death of the leaves is not, as is sometimes supposed, the consequence of their fall; nor is it occasioned by their nutriment being cut off, in consequence of the vessels of the leaf-stalk becoming clogged-up towards the end of the summer. The truth is, they have lived their time; have completed the term of functional activity allotted to them. We may always notice that, when this activity has been peculiarly great, in consequence of an unusually high temperature, the death of the leaves takes place earlier. They have ceased to perform their special function—that of fixing carbon from the atmosphere—some time before they decidedly change colour: and their subsequent exuviation is in accordance with the general tendency of all living parts, to detach from themselves such as are dead. But the correspondence in all essential particulars between the simplest Cryptogamia and the highest forms to which

vegetation can attain, is not confined to the nutritive process. The complex phenomena of reproduction in the flowering plants appear mainly to consist in a repetition of what occurs in the lowest instances of vegetable life. According to the latest and most exact observations on the interesting problem of the nature of the fertilising action, the formation of the embryo is the result of the mixture of the contents of one of the pollen-grains or cells, with those of the embryo-sac, which is a large cell contained within the ovule or immature seed; in which case it essentially corresponds with the *conjugation* of the lower algæ. The differences presented by the comparison of the two products, are quite subordinate to their essential conformity. Thus, while it would seem that *any* two cells of a palmella or a protococcus may conjugate for the production of a new generation, the action is restricted, in the flowering plant, to certain groups of cells specially endowed; an arrangement quite in conformity with the general plan of the 'division of labour,' peculiar to the higher groups. Again, whilst the new product of the simple cellular plant can readily provide for its own livelihood, and soon developes itself into the form and constitution of its parent, the embryo of the flowering plant passes through a long series of progressive phases before the parental form is evolved, and during the early part of the series it is dependent upon its parent for the materials of its growth. In *all* instances, however, the vegetable embryo has at first the condition of a simple cell; this cell multiplies itself by subdivision, and the new cells continue adherent to each other, so that a cluster of cells is generated, strongly resembling in their condition some of the lower algæ or fungi. From this cluster, a rudiment of the cotyledon or seed-leaf is evolved; and then the development of the stem and root begins. During the whole of this process, the young fabric consists of nothing but cells; and it is not until the end of the period of germination, when the true leaves are unfolded and come into play, that the woody tissue, vessels, &c., are generated.

Thus the condition of the highest forms of vegetable life is ascertained to be the same at their origin with that of the lowest. And, we are entitled to affirm that the whole history of the growth and reproduction of the most perfect

plant is essentially a repetition of the development and propagation of that simple cell, to which we have so often referred as the type of all organization.

Of the facts which constitute the basis of this generalization, the greater number have been, for some time, familiar to vegetable physiologists. But it has been only within a very recent period, that their mutual relationship has been completely developed, by the discovery of the essential conformity between the process of reproduction, in the highest and lowest forms of vegetative existence. That some conformity would be found to exist between the instrumental structures concerned in the growth and propagation of plants, and those by whose agency the corresponding functions of *animals* are effected, was a speculation in much favour with those physiologists who had the clearest view of the intimate connection subsisting between these two great hemispheres of the world of organization. But no one, we venture to say, was in the least degree prepared for the surprising discoveries which the microscope has recently brought to light, with regard to the elementary structure of the animal tissues, and the early stages of embryonic development. These discoveries have followed one another in such rapid succession, that but a few years elapsed between the announcement of the first of the series, and the completion and generalization of the whole. Various inquirers had detected the existence, in several parts of the animal body, of true *cellular* tissues; and had shown that the history and offices of the component cells were, in all essential respects, the same with those of the elementary parts of the vegetable fabric. These, however, were usually considered exceptions; and it was still the rule, that the elementary tissues of animals are entirely different from those of plants. The first great step in advance was made by Schwann. In the work, whose title we have placed at the head of this article, he first announced it as a general fact, that the animal tissues are all developed from cells; although the various metamorphoses which these undergo, in their progress towards their complete form, more or less obscure their original character. A host of followers immediately devoted themselves to the re-investigation of these elementary tissues.

His statements, limited and corrected on some points, have been so greatly extended and confirmed on others,—and his generalization, premature in some respects, has been so fruitful in novel results and widely-extended applications,—that he must be acknowledged to have done more than had been previously attempted or even conceived, towards elevating Physiology in the scale of sciences. Some of the general results may be made intelligible to all our readers.

The animal body contains many parts which are subservient to its *mechanical* functions alone. Thus the office of the *bony skeleton* is simply to afford support and protection to the softer parts,—to supply points of attachment to the muscles, by which the motive force is generated,—and to act as a system of levers, by which that force may be advantageously applied to the movement of the entire fabric. So, again, the purpose of the *teeth* is purely mechanical; and their solidity and durability are such, as almost to remind us of the homogeneity and permanence of inorganic masses. Further, in order to hold together the parts of the bony skeleton, and at the same time to allow them free movement upon each other, *ligamentous* cords and bands are interposed; which are composed of simple homogeneous *fibres*, some of them elastic, others non-elastic. The *tendinous* cords, by which the muscular power is brought to bear upon the bone; and the various *fibrous membranes* which are introduced among the muscles and other organs, for the purpose of binding them in their places, are of the same materials; as is also the case, though worked up in a different manner, with the tissue, so widely diffused through the body, which was formerly called *cellular*, but is now more correctly distinguished as *areolar*. In this tissue, the elastic and non-elastic fibres are woven into a network, the meshes or *areolæ* of which freely communicate with each other; and the one or the other kind of fibre predominates, according as an unyielding resistance to tension, or a certain measure of elasticity, is required. Its office is to hold together the elementary parts of other tissues (as bricks in a wall are held together by cement), and to form a sort of bed for the passage of the vessels and nerves, which it everywhere accompanies in their course and distribution. The same tissue, in a more condensed

state, forms, with blood-vessels, nerves, and lymphatics, the substance of the *true skin* which invests the exterior of the body; of the *mucous membranes*, which are prolonged from this into the alimentary canal, the respiratory cavity, and many other passages in the interior of the body; and of the *serous membranes*, which line the cavity of the chest and abdomen, and other 'shut sacs.' Now the function of these fibrous tissues is purely mechanical. We do not find them in plants, because plants, not being constructed for active movement, have no need of them; and we may regard them as superadded in animals, merely to bring their structure into conformity with the *physical* conditions of their existence. They possess no properties which can be properly designated as *vital*; and it need not surprise us, therefore, if they should constitute an exception to the general rule of the development of the tissues from cells. In fact, the solid homogeneous fibres of the fibrous tissues are decidedly beneath cells in the scale of organization; and it would even seem that the solid material of bone, possibly also of dentine, is formed by the chemical union of calcareous salts with similar gelatinous fibres. The complex apparatus of cavities and tubes, however, by which the *nutrition* of these tissues is provided for, is probably generated (as we should expect) by the growth and transformation of cells.

Turning now to those portions of the animal fabric which are the instruments of the truly *vital* functions; and first, directing our attention to the phenomena of organic life, which are essentially the same with those of plants; we have no difficulty in tracing out the general fact that all these functions are performed, in animals as in plants, by the agency of *cells*. Thus the selection and absorption of the liquid aliment which has been prepared by the digestive process (itself a truly chemical alteration), is effected by the agency of the multitudes of cells contained within the extremities of the *villi*, which act as so many little roots,—not spread out, indeed, through the soil in search of food, but suspended from the walls of the cavity containing it. The food so taken up is delivered over to the absorbent vessels, which, like the vessels that carry upwards the ascending sap of plants, convey the crude aliment to the organs in which it is to undergo concentration and

elaboration. Owing to the differences between the food of animals and that of plants, these processes are by no means identical in their character, but they are analogous in their general relations to the economy. For their respective products, the blood and the descending sap, although chemically different, agree in being the nutritious fluids of their respective organisms, and in containing all that is essential to the maintenance, reparation, and extension of each, and to the formation of their peculiar secretions. Now, the elaboration of the crude materials of the absorbed fluid appears to be effected in animals, partly by the cells (blood-discs and chyle-corpuscles) which float in the stream of fluid, and partly by the cells of which the peculiar glandular bodies, connected with the vascular system, are chiefly made up. Of these glandular bodies, some are placed in the course of the absorbent vessels, so that every particle of fluid is intercepted as it passes along them. Others (as for instance the spleen) are connected with the blood-vessels, and appear to be continually drawing from them the least perfect portion of their fluid, which they pour back into the circulating current, after having subjected it to an elaborating action by the instrumentality of their component cells. The nutritive fluid, thus completely prepared, is appropriated by the several tissues of the body, each selecting that class of materials which it requires for its own growth or renovation; and excepting in the simple fibrous tissues, which appear to be formed by the mere *fibrillation* (or coagulation with a fibrous arrangement) of the plastic element, every act of development and reparation essentially consists in the production of cells, and in the functions which they perform.

So far, then, there is an essential conformity between the constructive operations of the animal and the plant. And there is this further point of correspondence,—that, in the animal, as in the plant, the more durable portions of the fabric are formed by the means of cells, whose term of existence is comparatively brief. This production of cells, which, as in the case of the leaves of plants, are destined to serve a temporary purpose only, is peculiarly remarkable in animals, from the rapidity of their growth, and the equal rapidity of their decay. A new set of absorbent cells would appear to be developed in the interval between every meal;

and the generation and growth of the elaborating cells can be scarcely less rapid, considering that they all die as soon as they have discharged their products.

We find, however, that there is a limit in animals (save in the Zoophytic tribes) to the extension of the individual structure. As soon as the adult form and dimensions are once acquired, the nutritive operations are for the future concerned solely in their perfect maintenance. This difference is the consequence of the fact, that whilst in living plants there is little or no waste by decay (except in the death of the leaves), a constant decay of tissue is going on in the animal body, with a rapidity proportionate to the energy with which the animal functions are exerted. This fact, though not unrecognised by preceding physiologists, was first brought prominently into notice by Prof. Liebig. An important difference between the animal and vegetable fabrics depends upon it. If the products of these changes were allowed to accumulate in the blood, they would speedily act as deadly poisons: it is requisite, therefore, that they should be regularly eliminated or removed from the body. For this purpose a complex respiratory apparatus is provided. It acts by setting free the carbonic acid, —one of the products of decomposition,—at the same time that it introduces the oxygen which is required for the energetic action of the nervous and muscular tissues. But this interchange of ingredients between the blood and the air is a physical or chemical, not a vital, operation;—being simply accomplished by the exposure of the blood, in a very finely divided state, to the atmosphere, through the medium of a very thin membrane. It does not involve, therefore, the necessity for cell-agency. But another class of products is separated from the blood in a liquid state, by the agency of the cells, which make up the essential part of all glandular structures. Thus the substance of the liver (with the exception of its blood-vessels, absorbents, nerves) and excreting ducts, and some connecting areolar tissue, consists entirely of such cells; and it is their important office, in their growth and development, to separate from the blood the biliary matter which constitutes their appropriate food; and afterwards, on their dissolution, to deliver up their product to the duct, by which it is conveyed into the alimentary canal. All the other glandular structures

of animals are formed upon the same plan;—whether their purpose be to separate from the blood a material which is to answer some special purpose *in* the economy, such as the gastric fluid for the solution of the food; or whether, like the kidney, to separate those products of decomposition, which are to be at once carried forth *from* the body. In every case, the *selection* of the particular ingredients of the circulating fluid is an act of cell-growth, analogous in its own nature to that by which nutritive matter is introduced into the body, though differing in the purpose it is to serve in the general economy. The only secreting function in the animal at all resembling the separating process by which nutritive material is stored up in the cells of the vegetable fabric is the growth of *fat*. This substance consists of an assemblage of cells resembling those of plants in all essential particulars, but held together by areolar tissue, and surrounded on their exterior by blood-vessels. They separate from the circulating fluid its superfluous fatty matters, selecting these from it, just as the cells of the liver select bile, and those of the kidney urea. But instead of discharging these selected products, they keep them stored up in their cavities until there is a demand for them in the system; when they are again taken back into the current of blood, to be used accordingly.

In this manner, the whole series of the nutritive actions of animals is seen to be but a repetition, under various modifications, of the phenomena of that cell-growth which is also shown to be the life of the simplest plant. It remains to consider, how far the functions peculiar to animals,—those of the nervous and muscular systems,—may be included in the same general expression.

The *nervous* system consists of two different forms of elementary tissue; namely, the tubular fibres of which the nerve-trunks are composed, and the cells which are found in the central masses or ganglia. The tubular fibres are now well understood to be merely concerned in the transmission of nervous agency, their function being analogous to that of the conducting wires of a voltaic battery; they consequently bear some analogy to the vessels by which blood and other fluids are conveyed through the system. An uninterrupted continuity is indispensable to the performance of their function; and the function itself seems

at least as much allied to physical, as it is to vital agency. On the other hand, the nervous power, whatever may be its nature, is *generated* by the agency of the cells, which are the essential components of the ganglionic centres, and which are also found at the origin of certain nerves that proceed from the organs of sense towards these centres. Here, then, in that class of actions which seems the most removed of all the animal functions from the simple operations of vegetation, we find that the life and growth, the death and succession, of *cells*, still constitutes the essential part of the phenomena.

And, lastly, the most recent inquiries have shown that the *muscular* system forms no exception to the general rule; for this, too, in its ultimate analysis, is reduced to the same organic elements. There is no difficulty in showing that any muscle may be unravelled, as it were, into a vast number of bundles of fibres; and further, that, in the most perfect form of muscular structure, these fibres are tubular, and contain fibrillæ of extreme minuteness, which are, in fact, the real elements of the tissue. The peculiar markings upon these fibrillæ have been a source of much perplexity to microscopists, and many discrepant opinions have been entertained regarding them. Not only on this account, but also as being the last tissue which remained to be resolved, a peculiar interest attached to the question of its intimate nature. This interest was yet further increased by the consideration that, if it should prove to be cellular, the generalization, which had previously included only the organic or vegetative functions, might now comprehend the animal functions also. The problem was resolved simultaneously and independently by Professor Sharpey and Dr. Carpenter. Each fibrilla of muscle was discovered by them to be in reality a series of cells arranged in a linear series, like those of a *Conferva*; and the contraction of the muscle was shown to be simply due to an instantaneous change in the form of the component cells of the fibrillæ. The motions of the leaf-stalks of the sensitive-plant and Dionæa, those of the filament of the berberry, and others of like nature, all result from a change in the form of the component cells of the tissues of these parts, the change being due to the direct action of the stimulus by which they are called forth. The contrac-

tion of a muscular fibre may, in like manner, be excited by a mechanical or electrical stimulus immediately applied to it. The peculiarity which distinguishes it is its connection with the nervous system, and, through the nervous system, with the mind.

Thus, then, in all those material changes through whose instrumentality the mind is rendered conscious of the impressions of external objects; in those, too, which seem essential in our present state of being to the workings of the mind itself; and in those by which it reacts upon the world around it, by means of the movements which it excites in its corporeal framework; we have still the same agency at work.

With regard to the *reproductive* functions of animals, we must content ourselves with the simple statement that, whether in the extension of the parent structure by gemmation, in the detachment of buds capable of maintaining an independent existence, or in the origination of an entirely new generation, the foundation is invariably laid by the growth of cells, which may subsequently undergo more or less of transformation, according to the nature of the fabric to be evolved. Of the last-named of these processes—the origination of an entirely new generation—it would appear that here too, as in plants, the essential part consists in the mixture of the contents of two distinct cells, out of which combination the embryonic structure is built up. The embryo, when first distinguishable within the ovum, consists of a pair of cells. This soon multiplies itself, precisely after the fashion of the simplest cellular plant, so as to form a mass resembling a mulberry in shape and appearance, when highly magnified. And the component cells of this mass, which are at first precisely similar to each other in size and aspect, after a time present indications of the commencement of those changes by which they are gradually to be converted into the diverse organs and tissues of the complete creature. During the whole history of embryonic development, however, as in the nutrition and maintenance of the adult fabric, we recognise the same agency in continued operation;—every stage of the process being referable, like all the other manifestations of life, to the act of cell-growth.

Thus, then, the same simple and comprehensive expres-

sion of *cell-life,* which suffices to designate the course of the humblest and most short-lived being, through its growth, development, decay, death, and reproduction, includes, also, the whole series of phenomena presented by the most elaborate organised body, putting aside those which are strictly chemical or physical. Further than this it would seem impossible for any generalization to carry us. The physical philosopher has his laws of mutual attraction, laws of motion, and other similar comprehensive expressions of facts common to all matter; and it is indifferent to him whether he applies them to masses or to component particles, the laws being the same alike in both. But the existence of such laws is an ultimate fact in his science, of which he can give no other account than by referring it to the will of the Creator. So, in his law of cell-growth, the physiologist has a general fact common to all forms of organised being, under which he is enabled to arrange all the manifestations of life, however complex. Beyond the simple cell, however, he cannot go; for to attempt to separate this into its component elements, would be to destroy its character as an organised body. The *atom* of matter, whether real or hypothetical, represents the mass, because it has all the properties of the mass; but nothing less than a cell can represent an organised being, the essential idea of whose structure supposes a diversity of parts, and whose peculiar train of actions is destroyed by further division. The *cell* in Physiology, therefore, is what the *atom* is in Physics.

It is natural, however, that the physiologist should be asked to account for the diversities in the action of the cells, of which any single organism is composed. Thus he may be expected to inform us, why one of the cells of the embryonic mass develops itself into bone, another into muscle, and another into nerve; or why one set of cells in the adult structure absorbs nutritious matter, another converts it, and a third removes it when it has passed into a state of decomposition. He is constrained to reply, that he can give no reason for this at present; and that it is doubtful whether he will ever be able to furnish one. All that he can say is, that this variety of functions in the cells of a single organism does but repeat the variety which is met with in those elementary forms of vegetable life in which each cell

is a complete plant. For instance, that one group of cells in the human body should appropriate bile, another fat, another urea, and so on, is obviously a parallel fact to the production of red colouring matter by the simple *Hæmatococci*, of green by the *Chlorococci*, or of an azotised compound by the *Torula cerevisii* or yeast-plant. Such phenomena are the elementary facts of his science; of which he can give no other explanation, than the chemist and physical philosopher can give of the different properties of his inorganic elements,—as, for example, *why* one collection of atoms should possess the assemblage of properties which constitute it potassium, or *why* another should have the properties comprised under the designation of oxygen, or *why* these two should have a strong affinity for each other. To have arrived at a set of ultimate facts, so simple and comprehensive in their character as to be entitled to take rank with the ultimate facts of physical and chemical philosophy, is the great triumph of modern Physiology: and for this triumph Physiology is entirely indebted to the microscope, and the skilful use which has been made of it.

We shall not weaken the force of these statements by any commentary of our own. We undertook to demonstrate that the microscope, as an instrument of scientific research, is now fully entitled to take rank with the telescope; in virtue of its perfection as an optical instrument, of the new facts which it has brought under our cognizance, and of the comprehensive views which it has opened to us. The grandeur of these views must not be estimated by the space over which they extend, but by the conceptions to which they give rise in our minds. There is something indeed in the extremes of minuteness, which is no less wonderful,—we might almost say, no less majestic,—than in the extreme of vastness. If the mind loses itself in the contemplation of the immeasurable depths of space, and of the innumerable multitudes of stars and systems by which they are peopled, it is equally lost in wonder and admiration when its eye is turned to the countless multitude of living beings which a single drop of water may contain—to the wondrous succession of phenomena which every individual amongst them exhibits, and to the order and constancy which these phenomena present. Or, still

more, when we direct its scrutiny to the penetration of that universe, which may be said to be included in the human body, (and now said with a meaning unknown to those ancient philosophers who first designated it as a *microcosm,*) and survey the innumerable assemblage of elementary parts, each having its own independent life, yet each working in perfect harmony with the rest, for the completion of their most significant yet most mysterious whole. In the study of the one class of phenomena, no less than in the survey of the other, are we led towards infinity; and in both alike do we discern the orderly, uniform, and effectual ministration of a wise design, evolving the most varied and astonishing results from the co-operation of the most simple means.

Art. II.—THE RACES OF MAN, AND THEIR GEOGRAPHICAL DISTRIBUTION.

The Races of Man, and their Geographical Distribution. By Charles Pickering, M.D., Member of the Scientific Corps attached to the United States Exploring Expedition. 4to. London: John Chapman. 1849.

This splendid volume justly claims a place in every public library. Its price puts it beyond the reach of all but the rich, yet the materials which it contains ought to be accessible to all the studious, and will have much to interest even the superficial reader. The volume is in fact only part of a larger work, which contained an account of the Exploring Expedition sent out by the United States, in the years 1838-1842, under the command of Captain Wilkes, U.S.N. His ship was named the Vincennes. Dr. Pickering was associated to the scientific corps, in the capacity of Naturalist, as our own countryman Mr. Charles Darwin to the English explorers in the Adventure and Beagle. Mr. Darwin's peculiar taste and talent lay in Geology, and the sciences which minister to it: Dr. Pickering's attention chiefly rests on Botany, and on the varieties of the Human Species; though Zoology is not entirely thrown out of view by him. To Mr. Agate, a member of the Expedition, we owe most of the characteristic and ably-executed paintings of human specimens, with which this volume is adorned and illustrated. One plate, however, is from Mr. Drayton's pencil, and two from Mr. Prisse, in Egypt and Nubia.

In the course of this five years' voyage, Dr. Pickering visited Brazil, Patagonia, Fuegia, Chili, Peru, California, interior Oregon, various islands of the Northern Pacific, Southern Polynesia, Australia, the Philippines, Singapore, Bombay and the Deccan, Muscat, Mocha, Suez, the valley of the Nile, Zanzibar, Cape Town, St. Helena, Madeira, and the Cape Verd Islands. To condense the results of his researches would be a more elaborate and responsible task than we can take on ourselves, nor do we feel compe-

tent to pronounce scientifically on the very difficult problems which he takes in hand. It will suffice to indicate to our readers the direction of his investigations and the character of his work.

Dr. Pickering appears to have no doubt whatever of the original derivation of the whole human race from a single stock, nay, and from a single locality; in so far that he occupies himself with a scientific inquiry into that locality. He assumes that primitive man must have lived where clothing was unessential and art needless to life; and he finds these conditions in the Equatorial Regions only. Assuming further that no great change in the form of the earth's surface and the distribution of land and sea has taken place since a human population has existed, he inquires from what part of the tropics migrations might take place to people the whole globe, so as to produce phenomena most agreeable to the existing distribution of races. If we understand him (pp. 304, 305), he believes that the geographical problem would most easily be solved by supposing *two* primitive centres,—one in the East Indies and one in Africa,—whence two different human species diffused themselves: but physiology resists the doctrine of *two* species, and demands either *one only*, or certainly not less than eleven. Under this difficulty, he appears to acquiesce in the belief that the islands of the Indian Ocean are the truest home of the human family; where also the orang-utangs abound, "which in physical conformation, and even in moral temperament, make the nearest approach to humanity." Nay, in central Borneo, the realm of the pongo, it is known that a race of actual wild men and women exist, who make nests in the trees, and in external life, as in food, differ little from apes. Their adult males are often shot by the Dayaks, and their females and little ones captured; and there is no doubt whatever that the race is strictly human.

From the region of Sumatra, Borneo, and New Guinea, the islands of the Tropical Pacific would be gradually peopled. In how very rude a stage of barbarism an art of navigation is attained, adequate to such an enterprize, we are apt to be imperfectly aware. Especially coral-bound shores afford a profusion of animal life for man's support, in water, the temperature of which is delightful to the

human skin, and formed into lagoons where the violence of the surf is broken. Here the savage learns an amphibious life, becomes active in swimming, trusts himself to a simple log, defies the fiercest waves in a *catamaran*, or by a grooved trunk of a tree with a rude outrigger and sail. Before Forster and Cook visited the Society Islands, its natives were accustomed to make voyages to the Marquesas on the north-east, and even to the Samoan (or Navigator's) and Feejeean groups eastward; of which they constructed maps that have proved intelligible. One of the headlands of Hawaii has been found to bear the name of "the starting-place for Tahiti:" and, according to the account of the natives, the canoes used in former times to leave at a certain season of the year, and direct their course by a particular star to this very distant northern goal. Dr. Pickering believes that the Papuans, who reach from New Guinea to the Feejee islands, are (from unknown peculiarities in their past history) wholly indisposed to migration; while the inhabitants of the cloud of little islands to their north,—the Caroline Archipelago,—have all the enterprise and roving seamanship of the Polynesians. The Carolines therefore seem to be the bridge connecting the Philippines with the Central Pacific.

The MALAY race, in Dr. Pickering's view, extends from Sumatra eastward into Polynesia. In fact, the natives of Hawaii, as well as of Tahiti and the islands south of the line, and the New Zealanders, are included in it by him. The Californians also approximate remarkably to the Malays, so that no one need doubt by what route America was primitively peopled. The Atlantic is in apparent extent very inferior to the Pacific; but it is far less passable by barbarous man, in consequence of its want of islands. From Hawaii to California is indeed a vast gap, unbroken by islands in our best maps; yet the distance is considerably less than from Tahiti to Hawaii. Not the countenance only, but the softness of skin in the Californians, is regarded by Dr. Pickering as strikingly similar to that of the Polynesians. To the same race he refers the primitive Mexicans on that side of the Pacific, and on the other the Japanese, the Philippinensians, the Cochin Chinese, Siamese, and Madegassians; possibly also the Cingalese, and a part of the population of India and

Arabia. On the whole, he regards the Malay race as the most widely diffused, though not absolutely the most numerous.

Where and how the MONGOLIAN race branched off from the Malay, we do not find in him any very precise hypothesis: but from the Cochin Chinese, who are Malays, we pass to the Chinese, who are Mongolians. This same race spreads northward over the whole terrace-land of eastern Asia, and reaches out over the wide levels of Siberia. It crosses the Pacific by the Aleutian islands, and is found to people north-western America, where the *Chinooks*, who abound on its shores, and the whole population of interior Oregon, have a most decidedly Mongolian character. The Chinooks are rather more advanced in the arts of life than the Polynesians: their canoes are more elaborate, their mode of fishing more enterprising: while in most points they are superior to the hunting tribes of North America. In Oregon, from some unexplained cause, game is wholly wanting; so that hardly a wolf can live. The multiplicity of languages in that single country testifies to a wonderful isolation in human families, and perhaps implied a rapid dispersion across the breadth of the continent. The Aztecas (or native invaders of Mexico from the North) are referred by Dr. Pickering to the Chinook race; also in Yucatan, he believes the aboriginals to have been decidedly Mongolian. Those of the United States excel the Chinooks greatly in size; yet appear "in every respect physically identical" with their brethren west of the Rocky Mountains. We thus trace the Mongolians from China to Virginia. Dr. Pickering indeed avows the conviction which he had formed before his voyage, that the aboriginals of North America were fundamentally of the Chinese variety: and he informs us that a Feejee Polynesian whom they took with them in their roamings at once identified the Chinese at Singapore with the Chinooks of N.W. America. On the quick observation of savages, Dr. Pickering thinks much stress may justly be laid.—The great similarity of the Hottentots to the Mongolians of N. Eastern Asia has been much insisted on by some writers. Dr. Pickering complains, that, during his very short stay at the Cape, he was unable to get a sight of a Hottentot whose purity of breed he could trust: and he abstains from giving an opinion as to the

relations of this race, which seems once to have spread over the breadth of all Southern Africa.

The PAPUAN race is a third, of very marked character, but of very limited diffusion. They may seem to have been made for a continental life, as indeed their principal home (as far as hitherto known) is in the greater islands, New Guinea, New Britain, New Ireland, New Caledonia, —to which Borneo and Van Dieman's Land were probably once to be added. They are very indisposed to migration. Eastward, they reach only as far as the Feejee islands, which, in many respects, form a meeting place between the Papuan and the Malay races. The Papuans are characterised by Dampier, as tall, bottle-nosed, mop-headed negroes. The hugeness of their forms, the enormous size of their periwigs, which are often three feet in circumference, and the deep blackness of their skin, make it impossible for voyagers to describe them inaccurately. Their hair is so wiry and massive, that they cannot sleep comfortably without a wooden neck-pillow. Every filament has a spiral twist like a corkscrew, and will grow, if not cut, to the length of a foot. Their beards are long and bushy.

In the Papuans of Borneo (who are not numerous there) Captain Brownrig ascertained, what is probably true of this whole race, that the hair grew in small tufts separated from each other; so that when it was cropped close, the head looked like an old shoe-brush. The same peculiarity is attested concerning the hair of the Hottentot, who is, in most respects, very unlike the Papuan. The great quantity of hair on the lower limbs of the Papuan are thought to assimilate him more to the European than to the Negro race.

It was only in the Feejee islands that the expedition fell in with the Papuans; and to these accordingly Dr. Pickering limits his account. The hugeness of size attributed to this race might be received without wonder, if details were not given; but when Dr. Pickering adds, that the measure of a Feejeean's leg was found "to encircle *three* united of three of our men," we are set questioning whether American crews have preternaturally spindle shanks, or how the heart, stomach and lungs of the Feejeeans can, without exhaustion, feed limbs so uselessly big.

We wish Dr. Pickering had given us the measure in inches, and aided our weak imagination by a drawing of such a pair of legs. The tallest Feejeean whom he saw, was, he says, 6 feet 6 inches high. D'Urville remarks that in this people there is "*no obesity*:" "they are tall, well made, active, and muscular." Our author describes the tinge of their skin as showing purple in the sun, their countenances as apparently vertical like ours, and highly impressive, notwithstanding something negro in its outlines. The painting which he exhibits of Kombeti, a Feejee native, unites indeed immense physical energy with something intellectual, majestic, and morally fearless: and in spite of the slaughter of parents, cannibalism, and human sacrifices existing among them, their extreme ferocity, and the desperately bad opinion formed of them by the missionaries, — yet the entire account seems to show that they are, after all, the noblest race of those parts.

The loyalty of Europe feebly represents the devotion of the Feejees to their king. At his simple word the bravest warrior resigns himself to death without resistance, or obeys the mandate to become the executioner of his friend. Yet a time generally arrives, when this loyalty is overstrained and suddenly snaps; so that the king ordinarily dies at length by assassination. Indeed, as no old people are allowed to live when their strength fails, but it is the duty or privilege of every son to kill his aged parents,—the king, who ought to be their leader in battle, could hardly expect exemption from this common law. The wars of the different islands are often horrible in slaughter; but certainly not to be criticised by the European races. The skill of the Feejeeans in all the arts strikes every resident as far surpassing that of the Polynesians in general. "In architecture they have made no mean progress," says Dr. Pickering: they excel in domestic economy, (having an infinite number of ways of cooking human flesh!) cultivate a far greater variety of esculent plants, and are more skilful in navigation. They use the bow, and are dextrous with the javelin; but the club of Hercules is their favourite weapon. They play the panpipes and "nose-flute," and appear to have taste in all the fine arts. Indeed Dr. Pickering is persuaded that

they form the centre, from which the cultivation of Polynesia has spread. Every village has its temple, from which women are excluded; but in which strangers are entertained and lodged, and public feasts held, with "grace," toasts, and compliments. At Levuka is a high-pointed building, containing an Oracle. They have a fixed system of mythology, and a regular series of priests. Circumcision is practised by them. Everything appears to indicate an older and more consolidated state of the whole national institutions, than is generally found through Polynesia. D'Urville first observed that the Feejeeans are "the common limit of the copper or Polynesian, and of the black Oceanic race." Since then, the conclusion has been independently reached, as well by the resident missionaries, as by the highly accomplished and acute Secretary of the London Asiatic Society, Mr. Edwin Norris, that the Feejee is properly a Polynesian language. Mr. Norris believes that Tonga blood is mixed in the Feejee islands; but the order in which the population was introduced, remains as a problem for future inquirers. That the Papuans are an eminently improvable people, capable also of originating a various civilization, seems to us clear from this account.

Next to the Papuans, Dr. Pickering ranges the *Negrillo* race, or "puny blacks" of Prichard. They dwell in the New Hebrides, New Guinea, Luzon, the Andaman and other islands, and are of all human races the most monkey-like. Mr. Drayton has given us an amusing countenance of an Aramanga lad, as a specimen of this race. The moral expression is decidedly pleasing, and he is described as active, intelligent and docile. To distinguish between this race and African negroes, appears to us a work of great superfluity: nor does it appear that any chasm can be established between Negroes and Ethiopians on the one hand, or, on the other, between Ethiopians and Western Indians.

Dr. Pickering proposes a scheme of *eleven* races, as a minimum: viz., a. (White) Arabian, Abyssinian; b. (Brown) Mongolian, Hottentot, Malay; c. (Blackish Brown) Papuan, Negrillo, Indian (or Telingan), Ethiopian; d. (Black) Australian, Negro. The objections to this, as a scientific scheme, appear to us most obvious and decisive: but we

gather, that by *a race* he barely means what we would rather call a *form*. He sees a man with striking peculiarities, among other very different men; and he pronounces at first sight, "This man is of such and such a *race*." Yet he does not mean that his peculiarities must all have come from distant ancestors, running back indefinitely; for, we have seen, he believes all the races to have been propagated out of one primitive stock. A person who admits this, ought, we think, to give more weight to climate and localities than Dr. Pickering does. For instance, when he finds black Ethiopians on the lowlands, and fair men with features half Indian, half European, on the very elevated table-land of Abyssinia, he ought to attribute something to their local position. If Papuans and Hottentots can have been once propagated out of Arabs or Persians, it seems irrational to confine ourselves to the idea that such changes happened once only, and once for all. Dr. Pickering seems tied fast by the difficulty that three hundred years have not altered the European races in America, although this space of time has altered the plants and some of the animals imported thither. This surely proves too much for him. If it proves anything, it shows that mankind is of many original breeds; and of how many, it is then impossible to guess; they are to be counted by hundreds. But it appears obvious to reply, that civilized man shields himself from the elements, artificially preserves his habits, and with them much of his native type for many centuries longer than in the savage state would happen. On the other hand, it is too obvious to insist, that we must, on any theory, claim not hundreds, but tens of thousands of years for a Persian or Arab race to grow into mop-headed Papuans and square-faced Chinese. Give us but a geologer to mete out the age of the human species, and physiologists will probably feel no further difficulty about the *possible* origin of man from a single stock.

At the same time, it seems to us there is extraordinary confusion of thought among our best writers on this whole subject. They assume that "unity of species" *can mean* nothing else but derivation from a single pair of human progenitors, and, therefore, derivation from a single spot in the earth's surface. But this is not at all what we mean

when we attribute unity of species to any of the inferior animals. Indeed, it seems unimaginable, in the case of those weak races on which the stronger feed, that the Creative Power should have originally produced a single pair only, so as to expose the species to inevitable destruction by the loss of one life. No one who speaks of rabbits or sparrows as "all of one species," means to express any opinion concerning the past history and origination of the breed; he speaks of a present fact, unembarrassed by speculative difficulties. So, too, when we call mankind a single species, we mean to assert that this group of animals has certain intimate similarities, which associate it into one, and put a chasm between it and all others. These similarities of body and mind are such, that men and women, of any two races that can be picked out at random, are capable of entering into family relationships and common interests. They not only may have common offspring, but a common sense of Right, and Duty, and Religion—a common understanding and sympathy: so that there is neither physiological or mental impediment to any two races being fused into a single nation, possessed of all the attributes of humanity. This intimate congruity of body and mind is an undeniable fact, the moral importance of which is pre-eminent, and the moral influence of which ought not to be risked upon any theory or mythological opinion concerning the origin of Man. The unity of the species, and the moral rights of the individuals who possess its moral nature, remain unaffected, whether mankind have sprung from one or from a thousand pair of progenitors—whether these were brought suddenly into existence by a supreme fiat, or were gradually developed out of an inferior race, which had as yet no self-controlling moral faculties whatever. The fears of philanthropists on this matter have risen out of an ill-grounded and superstitious morality, according to which (it seems), if some antiquarian could prove that the most ancient Celts were a species of monkey, it would at once be legitimate for us to shoot the Welsh for winter sport, and pickle their little children as delicacies for the table.

The numerical estimate formed by Dr. Pickering of the eleven races is as follows, in *millions*:—

The White*	350	Negro . .	55	Negrillo .	3
Mongolian .	300	Ethiopian .	5	Australian	½
Malayan .	120	Abyssinian .	3	Hottentot .	½
Telingan .	60	Papuan . .	3		

But we hardly think he has given evidence that these eleven can, on his own theory, comprise the whole human race. Concerning the Kaffirs and other people of Africa (as Congo and the neighbouring regions), also concerning the primitive inhabitants of South America, nothing that we can remember appears in his pages. A map of the world is intended to exhibit, by various colours, his views concerning the dispersion of these eleven races; but, as often happens, the tints are so like one another, and so ill-exhibited in the very minute patterns, that we can make nothing of it.

Dr. Pickering does not appear to value much the aid of Comparative Grammar in assisting these researches: or, perhaps, rather we should say, that he looked to other minds, especially to a Mr. Hale, to discuss this side of the extensive discussion. Marsden, we believe, was the first to enter on the interesting question of the relation of the Malay and Polynesian languages; and since his day it has become increasingly manifest that the district of Oceanica contains more materials than any other part of the globe for elucidating the vexed problem concerning the diffusion of Man. One broad fact of contrast strikes us as deserving attention. Ever since Marsden, it has been recognized,—and, in spite of Crawfurd's objections, the conclusion has been reinforced by Humboldt,—that a single tongue, with only secondary modifications, reaches from Madagascar to Easter Island, through the space of 200 degrees of longitude. Contrast this phenomenon with the infinite multiplicity of languages in North America, where no two neighbouring tribes can understand one another! We can only explain this, as implying that in the former case human nations migrated in considerable masses, so as to retain their primitive speech; in the latter, single families plunged into the forest, and became so isolated as to lose all restraint on the tendency to re-invent language, and

* This epithet, with him, includes *black* Brahmins and Arabs, and (here) excludes *white* Abyssinians.

lose the old stock of words. May not this throw light on the great multiplicity of tongues which have astonished investigators in the region of the Caucasus? Vast mountains, like dense forests, which afford facilities for solitary life to single families, so that a single tribe may break up into ten in the course of a century, must be expected to produce in barbarous ages an immense variety of tongues mutually unintelligible.

The mythology of nations is as liable to change as their language; identity of mythology is, therefore, so much the stronger proof of relationship—except, indeed, where it can be accounted for as a speculation suggested by their physical circumstances. The Tonga islanders plant their gods in an oceanic "island of the blessed," similar to that described by Pindar, and believe earthquakes to be caused by the gigantic god Muwi, the earth-supporter and earth-shaker, who, however, does not, like Neptune, strike it with his trident, but, like the Typhos of Pindar, turns on his side when uncomfortable. Once upon a time, the ocean covered all the earth, and the god Tongaloa came down to fish. Having let down from the sky his hook and line, he caught something of immense weight, which resisted his efforts to raise it. Believing that he had hooked an enormous fish, he exerted all his strength: at last his line broke, just as he was heaving his burden above the surface. He had raised a vast mass of rock, the points of which projected above the water, and formed the islands of Tonga.—Compare this with the Greek story of Delos and other islands. Altogether, we are not sure that inquirers make sufficient allowance for the tendency of man to invent like tales under like circumstances. Yet it is not by accident that Mawi is also the name of a Tahitian god (Prichard calls him the *Prometheus* of the Tahitians);—Mauwi also is the mythical ancestor of the New Zealanders, who, with his brothers, is believed by them to have fished up New Zealand. Maui also appears as the name of an island close to Hawaii; but this, perhaps, is a coincidence which denotes nothing.

It has been known, since the time of Sir William Jones, that many Sanskrit roots enter into the Malay. Marsden showed that the phenomenon existed on a very great scale, and Dr. Leyden remarked that the Sanskrit words are far

purer in the Malay than in the Pali and in any modern Indian languages. Hence it has become a curious problem to decide on the nature of the relationship indicated. Bopp has boldly maintained that the Malay is to an earlier Sanskrit only what the Romance languages are to Latin; but this conclusion is not as yet substantiated, and the theory is more plausible which attributes the Sanskritism of the Malay to an Indian influence proceeding from Java. In all this, a field of wide research appears, where it may be anticipated that the phenomena will be found more and more numerous, and more and more fruitful of results, in proportion to the zeal and accomplishments of the inquirers.

Dr. Pickering subjoins to his work a number of curious and elaborate tables concerning the introduction of various plants and animals into America,—the islands of the Pacific,—Equatorial Africa,—Southern Arabia, Hindostan,—and Egypt. These last seem to warn us that an element of mere hypothesis enters his tables, and that they are not pure fact of observation or of testimony. Nevertheless, the mass of absolute information in them is great, and we suppose is hardly elsewhere accessible. We look on it as so praiseworthy a zeal in a London bookseller to furnish the English public with the rare scientific works of the United States, that we earnestly hope the reception given to Dr. Pickering's volume by our libraries will encourage similar importations.

Art. III.—THE RELATION OF THE SECOND TO THE FIRST AND THIRD GOSPELS.

Jo. Jac. Griesbachii Commentatio quo Marci Evangelium totum a Matthæi et Lucæ Commentariis decerptum esse monstratur. (Opuscula Academica, Vol. II., ed. Gabler. Jenæ, 1825.)

We may seem to be assuming to ourselves the province of *Retrospective* reviewers, in calling attention to an article so long before the world, as that of which we have just written the title. But as we intend to controvert the opinion that Mark has epitomized Matthew and Luke, and to claim for him the character of being the earliest of our Lord's biographers, we know not how we could proceed more fairly than by giving our readers notice that we have against us the judgment of one of the most eminent of modern critics of the New Testament. We do not, however, intend to enter into a minute examination of Griesbach's arguments. He has proved, what the inspection of a Harmony is sufficient to show, that nearly the whole of Mark is to be found either in Matthew or Luke; but the more important question, which has been the borrower, he passes over very lightly indeed. He seems almost to have taken it for granted that the shorter Gospel must be an abridgment of the longer. Yet if Mark, with the other Gospels before him, really designed to make an abridgment of them, he entitled himself to small thanks from those into whose hand his work came to the exclusion of the originals. The authors of Abridgments have never held a very high place among literary labourers; but we should be sorry to think that they could plead such a precedent as the Evangelist would in this case have afforded them. Let us conceive of an author sitting down to abridge Matthew, and leaving out the whole of the Sermon on the Mount; or with Luke before him, omitting the Parable of the Prodigal Son, the Good Samaritan, and Dives and Lazarus, the raising of the Widow's Son, the cure of the Ten Lepers, and the scene in the house of Simon the Pharisee. Never was parchment or papyrus more injudiciously

economised. Griesbach has not indeed overlooked the fact that Mark, whom he supposes to be the epitomator of Matthew and Luke, relates the same events as they do, often in a manner the most opposite to that of an epitome, adding minute circumstances to their more general narratives. In replying to the hypothesis of Storr, that Matthew and Luke had the Gospel of Mark before them, and copied from him the passages in which they coincide, he actually argues that this cannot have been the case, because "Mark sometimes surpasses Matthew in the perspicuity and distinctness of his narrative; nay, even is more accurate, and approaches nearer to the truth of facts, so that it is inexplicable why Matthew should in these instances have deserted him, while he elsewhere follows his footsteps." The superiority thus assigned to the non-apostle over the apostle, the second-hand relator over the eye-witness, is extraordinary, and very little accordant with the character of an epitomater. The hypothesis of which it is a necessary part will lose all probability, if we can show, as we trust we shall, that Matthew had a reason for his variations from Mark, in cases where, as Griesbach admits, Mark has related most accurately.

We are not about to discuss the question respecting the origin of the verbal harmony between the three first Gospels. We confess ourselves not satisfied with the original hypothesis of Eichhorn respecting the *Urevangelium*, nor its modifications by Marsh and others, nor with Mr. Norton's, of an oral tradition, formed by repetitions of the Gospel-history, in the apostolical preaching, and finally consigned to writing.* No doubt, if we can establish the priority of Mark's gospel to the others, it will go far to confirm the opinion that he was copied by his successors. But what we shall endeavour is to show from internal evidence, that his narrative, whenever published, was at least written before the other two, and represents therefore a tradition or recollection of our Lord's actions and teaching nearer to the time of his ministry than either Matthew's or Luke's. In conducting our inquiry, we must deal with the Evangelists as human biographers, not only possessing no supernatural sources of knowledge, nor

* Genuineness of the Gospels, I., p. 239, Ed. 2.

guarded from error by any divine superintendence, but men of "like infirmities with ourselves," and exposed to the influences of their age, their country, and their personal connections. Unless this be allowed in its fullest extent, there is no scope for our criticism. The *Deus e machina* puts an end at once to all human agency, and all reasoning upon human probabilities.

The very opening of the Gospel of Mark suggests the idea that it was written by one who had not acquired a notion of the relation in which the events he records stood to the history of the world, and therefore takes no pains to connect it with that history. Beyond its internal connection with the preaching of the Baptist and the procuratorship of Pilate, things essential to the narrative, there is nothing to fix the date of our Saviour's ministry. Nothing either in its opening or elsewhere has any reference to a future reader†; it appears more like a private record of facts which the author wished to preserve, than a book to be given to the world. How different in this respect are all the other gospels! Matthew* fixes the birth of Jesus to the reign of Herod the Great, and by implication the latter part of that reign, a date sufficient for the Jews, for whose special benefit according to the most credible accounts his gospel was written. The introduction to Luke's gospel on the other hand reveals a time when the ministry of Christ had become an event in the world's history, and therefore needed to be attached to the great chronological chain by a fixed and formal date. He not only tells us who was governor of Syria when the enrolment took place which caused his mother's visit to Bethlehem, but his own age at the beginning of his ministry, and enumerates all the rulers civil and spiritual of Judæa and the adjoining countries at the commencement of the Baptist's preaching. He writes at a time, too, when many had already taken the same subject in hand, and is anxious to impress his readers with the idea that he has used all diligence in preparing his own work. John's gospel is equally devoid with Mark's of all reference to chronology,

* That is as his gospel now stands. As far as we can make out from the confused account of Epiphanius (see Norton, i. 201), his original gospel began at the third chapter, with the words, "In the days of Herod came John the Baptist preaching," &c.

† see the 2nd note in p. 60, which belongs to this place.

but from a very different cause. He regarded the ministry of his master altogether in its spiritual, not at all in its external relation. "The kingdom of God or of Heaven," which forms so prominent a topic in the other Evangelists, and to which some ideas, more or less refined, of an outward and visible manifestation of divine power, was always attached, occurs only once in his gospel, where, in the discourse with Nicodemus, our Saviour teaches that a man must be born again, and of the Spirit, or he cannot enter it. He assigns to him no human parentage, but traces the Divine Word which dwelt in him to the bosom of the Father and the beginning of Time. For this reason we apprehend, not because a chronology was to be found in the other Evangelists, whom he could not reasonably presume his readers to have in their hands, he has said nothing of the time of Christ's appearance.

The termination of Mark's gospel bears the same character of a private record, rather than a book written for the public. As it stands in our Bibles indeed it appears to be finished off after the manner of a history, the subsequent fortunes of the gospel and its preachers winding up the whole. But critics are generally agreed that the last verses from the 9th inclusive to the end are not genuine, the weight of authority being against them, and the style obviously different from the rest of the gospel; at all events we may take this for granted, in examining Griesbach's opinion, since he distinctly admits their spuriousness. Is it then conceivable that any one sitting down to epitomize the gospels of Matthew and Luke, both of which relate (and Luke at great length) events subsequent to our Lord's resurrection, by which his history was brought to a natural close, should break off his own abridgment with the mention of the female disciples flying in terror from the sepulchre? Taking the commencement and the close of the gospel together, we cannot regard it in any other light than as a document carried on from day to day during our Lord's ministry, and terminated with the visit of the female disciples to the sepulchre, by which the fact of his resurrection was ascertained. The first verse as it stands in our Bibles reads, it is true, like the title of a book, "The beginning of the Gospel of Jesus Christ the Son of God," the more so as the false pointing of the common

version connects the first verse with those which follow; whereas it should stand alone, and is merely a summary of what is afterward related more fully (v. 14), the beginning of our Lord's preaching.*

How early the composition of this document must have taken place, is evident from the circumstance that *Apostle* had not yet become a title. In Luke and in the Acts it is repeatedly given to the Twelve, just as at the present day; in Mark never. It occurs once, and only once, in his Gospel, but in circumstances which clearly mark the difference of usage. The manner of their first mission is related with no important difference, by the three Evangelists (Matt. x. 1; Mark iii. 14, vi. 7; Luke ix. 1), except that Mark mentions their being sent out *two and two*. When they return from their mission, Mark (vi. 30) gives them the name of *οἱ ἀπόστολοι*, but evidently in the sense of *οἱ ἀπεσταλμένοι*, "those who had been sent out," the name having a reference only to this special mission; and, accordingly, he never again applies it to them. In Matthew's account also, though some precepts and warnings are represented as given to them, which belong not to this temporary mission, but to their subsequent office as preachers in a hostile world (Matt. x. 16), no mention is made of the title of Apostle being conferred upon them. Luke, on the other hand, says he *named* them Apostles (vi. 13), and accordingly gives them this title in the subsequent history (xvii. 5; xxii. 14). The order in which we suppose the Evangelists to have written, will explain these differences. Mark, writing nearest to the time and with the most exact recollection, represents the mission and the name as temporary, and the instructions as adapted exclusively to that mission. Matthew here, as elsewhere, has brought together things said by our Lord at different times, as if they were parts of one address. Luke, writing when the name had become the recognised title of the Twelve, represents our Lord as giving it them when they were first sent out, and proleptically applies it to them during his ministry. At the same time he transfers to a later and more appropriate part of the history, the warning of the persecution which they might expect (xii. 11), and the

* Mark xiii. 14 (*ὁ ἀναγινώσκων νοείτω*) contemplates a reader, but it is evidently an interjectional remark.

promise of the suggestions of the Holy Spirit to enable them to defend themselves; which Matthew represents as preceding their first mission, in which they might look for unbelief or neglect, but not persecution. To the same head of priority of composition, and consequently more lively recollection, we should refer the numerous passages in which Mark, relating the same event as Matthew or Luke, accompanies his narrative with those minute circumstances which impress an eyewitness, and, when the event is recent, are as distinctly remembered, and therefore as naturally set down, as the more important matters for the sake of which the story is related. As the same narrative passes from a contemporary journal to a formal biography, and still further to a history, these circumstances, the adjuncts rather than the essentials of the story are gradually dropt. Where the same events are related Mark is more circumstantial than Matthew, and Matthew than Luke, though the difference is not so great between the last and the second, as between the second and the first. We shall give some examples, following the order of our Gospels.

In the account of the calling of James and John, Mark (i. 20) says, that they left their father in the fishing vessel "with the hired servants;" Matthew (iv. 22) omits this last circumstance, but mentions their father Zebedee; while Luke (v. 11) makes no mention even of the father. In the history of the preaching of the Gospel, such as it was his purpose to write, it was of no moment who was left behind in the vessel; the important point was that the Apostles immediately obeyed the call of Christ, left all and followed him. In the account of the crossing the Lake to the country of the Gadarenes, Mark (iv. 35) mentions that other small boats accompanied the vessel in which our Lord embarked. It was a circumstance which would strike a journalist recording what he saw; but it was of no importance as a link of the narrative, for these boats gave no aid in the storm which ensued, nor are their crews ever mentioned again; and no notice is taken of them by Matthew and Luke, though in other respects they closely agree with Mark. In the narrative of the cure of the paralytic man, Mark (ii. 1, 3) begins by saying that when it was known that he was gone into a house, great numbers

came together, so that there was not even room to get to the door, and then proceeds to relate how the cripple was let down through the roof. Luke (Matthew ix. 1) is here very concise) says nothing of the *assembling* of the crowd, but alleges its existence (v. 19), as the reason why the bearers carried the cripple up to the housetop. This difference is instructive. The journalist sets down circumstances in the order in which they occur, the historian introduces them when necessary to explain the connection of events.

After his transfiguration our Lord descends from the mount and cures a lunatic boy. Mark (ix. 14) thus describes the transaction: "When he came towards his disciples he saw a great multitude about them, and scribes disputing with them; and the whole multitude was struck with awe when they saw him, and ran towards him and saluted him." This is the style of the eyewitness and contemporary recorder. Matthew simply says, "When they came to the multitude a man approached him kneeling" (xvii. 14). Luke only, that the "multitude was waiting for him" (ix. 37). But the eager rush of the crowd towards Jesus on his appearance is clearly no circumstance added by Mark to enliven the narrative: the disciples had failed in their attempts; and therefore it was that the appearance of the master was hailed with such emotion. Twice it is recorded that our Lord had children before him, and in both cases Mark mentions that he took them in his arms (ἐναγκαλισάμενος αὐτὸ, ix. 36, x. 16), a circumstance not noticed by the other Evangelists (Matt. xviii. 2; Luke, ix. 47; Matt. xix. 13; Luke, xviii. 16). It was not necessary to the lesson of humility in the one case, or the benediction in the other, that he should take them in his arms; and it is dropped by the historians: but who that enters into our Lord's character can doubt that Mark's is the true and full account? Nor was it important to the moral of the story of the young man who inquired what he should do to inherit eternal life, that we should know that when "Jesus looked on him he loved him;" a circumstance which Mark alone mentions (x. 21—comp. Matt. xix. 16; Luke, xviii. 19), but in which we recognise the Saviour, observed by a living witness, who records his impression while the colours of memory are yet warm and glowing.

Mark (x. 32) thus describes our Lord's disclosure of his approaching sufferings to his disciples: "And they were on the way going up to Jerusalem, and Jesus was going before them, and they were filled with awe, and were afraid as they followed; and Jesus again taking the twelve began to speak to them of the things which were about to happen to him." This graphic description of the disciples lingering behind their master in perplexity and dread while he goes boldly onward towards the scene of his suffering, Matthew (xx. 17) reduces to the simple announcement, that as "Jesus was going up to Jerusalem he took the Twelve apart on the way, and said to them."—And yet Mark is called an epitomater of Matthew. As Jesus enters Jericho, blind Bartimæus, the son of Timæus, sits by the way begging; and hearing that Jesus was passing, cries aloud for aid. Our Lord passes on, and the crowd reprove the blind man; but he cries the more loudly, and our Lord halting, when he was beyond the reach of his own voice, commands those about him to call Bartimæus.* The command is repeated to him; and casting away the incumbrance of his upper garment, he rises from the ground and comes to him. This is the account of Mark (x. 46); that of Matthew (xx. 29) is substantially the same, except that he speaks of two: but he has dropped the circumstance, that Jesus called him by the medium of others, and the throwing aside his garment, which marks so strongly the eagerness of his hope. We shall mention but one contrast more under this head. In the introduction of the prophecy concerning the destruction of Jerusalem, Mark says (xiii. 1), that as he was going out of the temple one of his disciples said to him, Master, lo! what large stones and what large buildings!—a remark most naturally suggested by the unusual size of the substructions by which the Temple was supported, precisely at the place where they must have descended in order to cross the valley and reach the Mount of Olives. In Matthew it is said (xxiv. 1) that as he went out from the Temple "the disciples came to him to show him the buildings of the Temple;" as if the whole body, or a considerable part, had gathered

* Elsewhere Mark is more precise than Matthew in regard to names (v. 22), and a remarkable instance (xv. 21).

round him for the express purpose of drawing his attention to the Temple architecture, instead of its being the passing remark of one, suggested by the special locality. Luke's description is still more vague: "When some said concerning the Temple, that it is adorned with beautiful stones, and offerings, &c.;" a remark which might have been made anywhere. Matthew omits the interesting circumstance, that when our Lord prophesied the destruction of the Temple, he was "right over against it" (Mark xiii. 3). Luke says nothing of the locality in which the prophecy was delivered.

If we compare the accounts given respectively by Mark and the other Evangelists, especially Matthew, of our Lord's actions and discourses, we shall generally find those of Mark recommended by their internal evidence. We take the example of the conversation between Christ and the Syrophœnician woman (Mark vii. 25-30; Matt. xv. 22-28). When she prefers her request for the cure of her daughter, our Lord answers, according to Mark, "*Suffer the children to be filled first of all*; for it is not right to take the children's bread and cast it to the dogs:" but according to Matthew he says only, "it is not right to take the children's bread, and cast it to the dogs." Between the two expressions there is all the difference of a harsh refusal and a gentle putting aside of the request. Our Lord's mission was primarily to the lost sheep of the house of Israel; this woman was, as Mark informs us, a Gentile (Ἑλληνίς), and he therefore intimates to her that the time was not yet come when those of her nation could partake of the benefits of his divine power. There is no humiliating contrast drawn between the two classes, as if the food destined for the children would be profaned by being cast to the dogs, but the children of the house must *first* be served, and the food prepared for them not given away till they are filled. And this brings out the beauty and aptness of the answer which affection suggested to the mother, "True, Lord, for *the dogs* (κυνάρια) *under the table* eat of the children's crumbs." Adopting his own illustration, she makes good her petition; "the dogs" (not unclean animals banished from the house, but favourites admitted to the same apartment with the children) "are not condemned to wait till the children have finished, but, as the meal goes on, gather the

crumbs. And so, while thou displayest thy beneficent powers profusely among thy countrymen, deign to let fall one blessing on the head of a Gentile." Mark has been charged by Strauss with a disposition to exaggerate the statements of the other Evangelists. We think the reverse is the case—certainly in the following instance. In reporting the simile of the grain of mustard-seed, Matthew and Luke represent our Lord as saying, "it becometh a great tree, so that the fowls of heaven lodge in its branches." We need not inform our critical readers with what fruitless labour the botany of the East has been explored for a plant bearing the name of σίναπι, which grows into a tree, and yet can be reckoned among potherbs (λάχανα). The passage in Mark (iv. 31) presents no difficulty: he does not call it a tree, nor does he say that the birds of the air lodge *in its branches*, but *under its shadow*.* This is true of the plant even in our climate, much more in the East. If there is exaggeration here, it has not been on the part of Mark. So, in the account of the resurrection, Mark's "young man clad in a white robe," becomes in Matthew "an angel, whose countenance was as lightning, and his garment white as snow."

It may be said these contrasts prove that Mark retained more faithfully or repeated more judiciously his master's words and actions than Matthew or Luke, but not that he wrote before them. But there are other passages in which the difference has evidently proceeded from a desire on the part of the later Evangelists to avoid what to popular apprehension might seem to derogate from the character and dignity of the subject of their biography. Now the whole history of the doctrine respecting our Lord's person, character, and office, from the time when Peter described him as "a man approved of God," to the concoction of the Nicene Creed, was one of gradual exaltation. Hence a presumption arises that of his own biographers he who speaks of him with the greatest freedom and plainness

* Wetstein on Matthew xiii. 32, quotes a Rabbinical author. "Dixit R. Simon f. Chalaptha: Caulem Sinapis habui in horto meo in quem ascendi, sicut ascendere quis solet in summitatem ficus." We fear this mustard-plant belongs to the same department of botany as a well-known beanstalk. It is, however, a good illustration of the passage in Matthew, only not exactly in the way that the commentator has taken it.

wrote before the others. This quality certainly belongs to Mark. There is a rough simplicity in his phrase which those who followed him seem to have thought hardly respectful enough. Mark (i. 12) says of Jesus, "the spirit driveth (ἐκβάλλει) him into the wilderness;" Matthew, "he was led up of the spirit;" Luke, "he was led in the spirit." When he had withdrawn himself from the multitudes, Mark says (i. 36), "Simon and those with him pursued him (κατεδίωξαν), and told him, all men are seeking thee." Luke says, "the multitudes came to him and urged him not to depart from them." Mark (iii. 21) relates that on one occasion the connections of our Lord attempted to lay hold of him, apprehensive that he was beside himself. Matthew and Luke omit this circumstance, as if derogatory to their master; though by so doing they deprive their reader of the key to the sarcasm of the Pharisees, that he cast out dæmons by the prince of the dæmons, i. e. that he was himself mad (Matt. xii. 22; Luke, xi. 14). In the account of the cure of the man who had a withered hand on the Sabbath-day, Mark says (iii. 5) that Jesus "looked round with anger" on the hypocrites who were watching him (comp. x. 14, Ἰησοῦς ἠγανάκτησε); Matthew and Luke omit the circumstance of his anger (Matt. xii. 11; Luke, vi. 8). In the narrative of our Lord's seeking fruit upon the fig-tree and finding none, Mark tells us plainly (xi. 13) that it was not the time of figs;* apparently not thinking it derogatory from his master's honour, that with his mind full of thoughts of infinite moment, he should have forgotten that it was not the season when edible figs were to be looked for. Matthew makes no mention of the season. Mark represents Peter as saying the next day, "The fig-tree *which thou did curse* hath withered away." In Matthew the disciples simply observe, "How suddenly hath the fig-tree withered away" (xxi. 20). The people of Nazareth, astonished at the teaching of Jesus,

* So ὁ καιρὸς τῶν κάρπων (Matth. xxi. 34) is the time of the grapes being ripe, as the owner of the vineyard would of course not receive his rent in green grapes. The time of gathering and the time of being ripe are one and the same. The circumstance of the fig-tree having leaves, was a proof that it was alive; had there been neither fruit nor leaves it might have been dead already; and there would have been no proof that it had perished in consequence of the imprecation. There is no ground for the usual epithet of the *barren* fig-tree.

exclaim, according to Mark (vi. 3), "Is not this *the carpenter*, the son of Mary?" but in Matthew (xiii. 55), "Is not this the *son of the* carpenter?" According to Mark, our Saviour, speaking of his second coming, says, "of that hour knoweth no one, not even the angels who are in heaven, *nor the son*, but the Father only" (xiii. 32). Matthew (xxiv. 36) repeats the declaration, but omits the emphatic acknowledgment which Christ makes of the limitation of his own knowledge. Taken singly, these instances might be explained away: but it is difficult to resist their cumulative evidence.

The strongest proof, however, to our minds that Mark's Gospel was prior in order of composition to the other two, is the different manner in which they represent the performance of miracles. There are repeated instances in Mark in which the use of natural means is recognised. When the mission of the Twelve is spoken of (Mark vi. 13), it is said, "They *anointed many sick with oil*, and healed them;" in Luke (ix. 6), it is, "They went through the villages, healing everywhere." In Mark's report (vi. 2), the people of Nazareth say, "What is this wisdom that is given him, that these mighty works are done by his hands?" In Matthew's (xiii. 54), it is simply, "Whence hath this man this wisdom and these mighty works?" Mark, in the same chapter, says, "He *could not* do any mighty work there, on account of their unbelief, except that he put his hands on a few sick, and healed them;" Matthew, that he *did* not many mighty works there. Mark relates, that when a κωφὸς μογιλάλος was brought to Jesus, he took him apart, put his fingers into his ears, spat and touched his tongue; of all which nothing is said by Matthew.* In the account of the blind man cured at Bethsaida (Mark viii. 22), we have the same description of our Lord taking him apart, and restoring his sight by degrees, and by the employment of his hands upon him; but as there is nothing corresponding to this section of Mark in the other two Evangelists, we are deprived of the means of comparison. The difference of tone, however, in the narration of miracles, is evident throughout the Gospels. Thus, in the account of the cure of the lunatic boy, Mark represents our Saviour

* Our Saviour's employment of natural means is recognised in John ix. 6.

as questioning the father respecting the duration of the malady, and describes the violence of the paroxysm which followed the command to the evil spirit to come out, and which left the child to all appearance dead, till Jesus took him by the hand, and raised him up. According to Matthew, he says, "Bring him hither to me; and he rebuked him, and the dæmon came out of him, and the boy was healed from that moment." In the case of Jairus' daughter, Mark represents the father as saying that his daughter was at the point of death (ἐσχάτως ἔχει); Matthew, that she was already dead (ix. 18). In the scene at the house, Mark dwells on the address to the maiden, the selection of the witnesses, the direction to give her food; Matthew sums up all in "The damsel arose." Mark only says, that when the Syrophœnician woman returned home she found her daughter lying on the bed, and the dæmon gone out; Matthew, that our Lord said, "Be it unto thee as thou wishest; and her daughter was healed *from that moment*." Mark describes the fig-tree as being found dried up the next morning, when the disciples passed that way again; according to Matthew, it "withered instantly." We repeat, that a single instance of this kind would prove nothing; but a phenomenon running through the whole of two parallel histories must have some cause in the peculiar circumstances of the writers. We can conceive no cause why Mark, if he had Matthew's narrative before him, should insert such circumstances as we have pointed out, but can readily imagine why Matthew should omit them. Mark wrote simply to record; Matthew and Luke to impress and convince. We have already said that we could argue this question only on the ground that the Evangelists were human biographers; and who ever undertook such an office without a leaning to that which exalted the power and worth of the subject of their biography? The accounts of Mark do not bring our Lord's miracles within the compass of natural causes, but their effect is more striking when all mention of natural causes is omitted.

It may be remarked that, although there are many precepts and parables in Matthew which are not found in Mark, there is hardly one *historical event* which they have not in common. The most remarkable exception is the

entire absence of the history of the conception, birth and childhood of our Lord. Without entering into the question respecting the authenticity of this portion of the Gospel, we have no difficulty in regarding its absence in Mark as a proof of the earlier origin of his work. Not only is it inconceivable that if he had Matthew and Luke before him he should have deliberately omitted all this part, but he could never have published a history of his own without some equivalent for it, had he written after the time when curiosity was directed to the early years of our Lord, and the facts recorded in Matthew and Luke had been discovered or imagined. We should apply the same argument to the details and scenery of the Temptation in Matthew and Luke, which Mark passes over with a brief notice of the fact. Our Lord's retirement into the Desert took place before the calling of the Apostles—before he had done anything to cause his actions to be watched. An authentic account of it, therefore, could only be derived from himself and his subsequent communications to the Apostles. We are aware that he uses the established language of the Jews respecting Satan, but to our feelings this is widely different from his describing to his followers the bodily appearance of the principle of Evil, with whom he holds conversations, and by whom he is transported from place to place. It seems far more probable that Mark represents the whole extent to which the belief of his followers had reached when he wrote—the simple fact of a temptation, and that the rest is the expansion of a subsequent though still very early age. Even the fact as stated by Mark must be considered as resting on a very different basis of historical credibility from those to which the countrymen of Jesus were witness.

Some events related by Matthew alone do not carry with them the same credibility as those in which the other Evangelists agree. Thus his account of Peter's walking on the sea (Matt. xiv. 27) is not only rendered doubtful by the silence of Mark (vi. 51), but seems to be contradicted by John (vi. 21), who says that the vessel reached the shore immediately after they had taken in Jesus. The narrative of the fish caught to pay the trifling sum of fourteen pence tribute-money is found only in Matthew, and is little in accordance with the ordinary

character of our Lord's miracles. The account of the sleeping saints who came forth from their tombs, and went into the Holy City, and appeared unto many (Matt. xxvii. 52), has been a stumbling-block to thoughtful readers. The saints, we presume, are those who had believed in Christ between the commencement of his preaching and his resurrection. Such a collective epithet for believers, though common in the Epistles, would not, we think, have been applied to them by any contemporary recorder, nor indeed by any one who did not write after Christians had become a separate community.* When we speak of the Gospel of Matthew, it should be remembered that it is a very doubtful question when it received its present Greek form. One of the few facts respecting the Gospels which the tradition of the church has preserved, and which we can receive with confidence, is that the original was in Hebrew, and that it had not the introductory chapters of our present copies. But as that Hebrew original is lost, we have no means of judging in what other points it differed from the translation.

We do not recollect an instance in which, Matthew and Mark differing, the account of Matthew recommends itself as more credible—there are many of which the reverse holds true. In the narrative of our Lord's entry into Jerusalem, Mark, supported by the independent testimony of John, describes a single colt as fetched and used. But there was a prophecy in Zechariah (ix. 9), believed to refer to the Messiah, in which, by the ambiguous rendering of the Hebrew *vau*, it appeared to be predicted that he should ride on an ass *and* (instead of *even*) a colt the foal of an ass. Now in this case it is impossible to deny that the account of Matthew, who represents both as being fetched and both ridden upon (ἐκάθισεν ἐπάνω αὐτῶν, xxi. 7), has been modified by the prophecy. The whole difficulty of the history of Judas has arisen from the same source. As Mark and Luke relate it, he bargained to deliver up his master for a sum of money (not the paltry sum of thirty pieces of silver), and, according to Luke in the Acts, pur-

* A similar remark applies to the use of the word ἐκκλησία, which is of perpetual recurrence in the Acts and Epistles, but is found in the Gospels only in Matthew xvi. 18, xviii. 17. It is clearly inappropriate to the age of our Saviour's ministry.

chased with the price of it a small property (χωρίον), and soon after falling down headlong, was so miserably mangled, that the place retained the name of the Field of Blood. The neighbourhood of Jerusalem abounds with precipices; but as the spot on which he fell was the very same which he had purchased with the wages of his iniquity (Acts, i. 19), no doubt the Christians saw in it the hand of God. They were open to all the influences which dispose man to see in extraordinary coincidences of crime and calamity the marks of a divine judgment; the moral was made more impressive in popular report; it was not enough that Judas should have perished on the field which he had purchased; he must be the victim of remorse, and avenge his crime upon himself (Matt. xxvii. 5). Is not this what passes every day before our eyes? Is it not equally accordant with our experience that various explanations are devised of names compounded of significant elements, such as Aceldama? The mention of the thirty pieces of silver we owe to the misapprehension of a prophecy (Zech. xi. 13); and as some very striking examples of this are found in the introductory chapters, which we have reason to believe were not in the Hebrew original, we think it may be set down to the account of the translator, who must have lived when popular tradition had had time to attain to maturity: For we are far from imputing to him the invention of facts to accord with his own views; no doubt he found the tradition which he adopted. We need only open a volume of a popular interpreter of prophecy to perceive how much the foregone conclusion that a prediction must have been accomplished in a particular series of events, predisposes the expounder to acquiesce in forced interpretations and accept doubtful statements. Yet who would call Newton or Keith dishonest men?

The attack made by Strauss upon the evidences of Revelation was like that of the red Republicans and Socialists on the institutions of society—blind and furious, and short-lived in its effects. Yet there is something to be learnt in both cases from the assailants whom we have repelled. The distinction between myth and history cannot be fixed by any line chronologically drawn; the so-called apostolic age, within which all miraculous agency is credible, and beyond which all is fabulous, is a period not to be defined.

The tares and the wheat, the true and the false narrative, sprang up together, the occurrence of the true wonder being indeed the excitement to the production of the false. It is not therefore by the wholesale denial of the possibility that mythic narratives should have gained belief in the Christian community, or even found admittance into our canonical histories, but by discrimination, that Strauss must be encountered. The probability of such a mixture increases in a rapid ratio with the time that intervenes between the supposed occurrence of a fact and its record in writing. If the earliest extant history of Christ's ministry had really been written no earlier than the middle or end of the second century after his birth, it would not have been easy to dissipate the haze in which Strauss has invested it. For this reason we have endeavoured to show that the second of our Gospels (we have called it Mark's for convenience, without assuming anything respecting its authorship) contains a very early if not a contemporaneous record. And we do not fear that what we have written will be considered unfavourable to the evidence of Christianity, except by those who are more concerned about the extent than the solidity of their structure, and prefer a wide area of sand for its foundation to a narrower basis of rock.

Art. IV.—MILL AND WHEWELL ON THE LOGIC OF INDUCTION.

1. *A System of Logic, Ratiocinative and Inductive, being a connected View of the Principles of Evidence and the Methods of Scientific Investigation.* By John Stuart Mill. In 2 vols. Second Edition. London: John W. Parker, West Strand. 1846. Book III. Of Induction.

2. *Of Induction; with especial reference to Mr. John Stuart Mill's System of Logic.* By W. Whewell, D.D., Author of the "History and Philosophy of the Inductive Sciences." London: John W. Parker, West Strand. 1849.

It is not without reason, that original speculation in physical and metaphysical science is so seldom pursued with any very considerable success by the same mind. The process by which laws of nature are first detected, differs in one respect so essentially from that which attempts the analysis of mental phenomena, that the very habits of thought most favourable to the physical discoverer may only impede or defeat the efforts of the mental philosopher. The difference alluded to is this, that while we can recognise no ties of necessary connection between the causes and effects of the physical world, mental investigations are performed on our own minds, through the agency of a conscious reflection, which brings conviction in the very process of a true analysis, without waiting for the subsequent verifications from experience. All proofs of physical connection are only indirect; the hypothetical causes having no *intrinsic* evidence in their favour, but owing their reception either to the absence of any other possible cause, or to the overwhelming presumption afforded by new and correct inferences that verify the guess; but antecedent to all verification, or rather *as* its verification, the mental philosopher has the evidence of his own consciousness as to whether his analysis be correct: the cause and consequence being connected in the same fact of

consciousness, he has with him the same kind of intrinsic evidence that belongs to deductive reasoning; he can tell at once whether it could or could not produce a similar effect, without recourse to experiment;—he carries some criteria of truth along with him even while he reasons, and so accustoms his mind to expect at once at least apparent presumption, a conscious perception of *some* internal relation between the supposed cause and the effect, even before he begins to judge. The mind of the physical discoverer, on the other hand, must be governed chiefly by general and slight analogies in its first suspicions concerning causes; analogies drawn from the physical sciences themselves, and which would have no force with a mind not already familiar with the general resemblances that they afford. By the very same consciousness by which we are cognizant of a mental effect, we have also been cognizant of the mental antecedents which produced it; but when we perceive a physical effect, we have no data whatever given us to trace the history and mode of its formation. Hence the analysis of direct inspection which serves the mental philosopher, is wholly different in its requisites from the processes of physical investigation, and he who should take to it the habits of thought he had acquired from them, would miserably fail.

This remark may, perhaps, serve to explain why so eminent a scientific philosopher as Dr. Whewell has failed so remarkably in his attempt to create a philosophy of science; why the History of Physical Science, which he wrote with so much ability, prepared him so little to analyze its mental processes, and expound its logic. A study of sciences where the mind can discover no *necessary* connections between cause and effect, and has to look for the indications of probability, and follow out the traces of analogy, were but little likely to discipline a mind, apparently never very subtle or exact, for the close analysis of its own actions, and the detection of its own laws. Dr. Whewell could not have shown more completely his utter incompetency to estimate the difference in kind between the various sources of moral certainty, than by classing together, as he has done, the laws of motion and even the laws of chemical composition, with the truths of mathematics, and the variously stated principle of universal causa-

tion itself. We regard it as unfortunate for the truth and perfectness of Mr. Mill's able work, that he should have had so feeble an antagonist (in its purely philosophical part) as Dr. Whewell. It will be said, perhaps, that Mr. Mill's powers of analysis might be regarded by his opponents with as little esteem as those of Dr. Whewell, because he also has classed *a priori* with *a posteriori* truths, referring them equally to the influence of constant association in experience: but there is this distinction. The theory which assigns experience and association as the source of all our knowledge, does at least provide for different *gradations* in moral certainty in proportion to the constancy and universality of experience; but those who would drag down all certainty to the level of empirical truths, who assign the highest degree of human certainty to the mere known succession of physical facts where no necessary connection can possibly be perceived, only show that they are utterly unable to estimate the highest degree of certainty at all, because they can discern within themselves no necessity of belief more stringent than the habits of thought which they have gained from their particular range of experience. While Mr. Mill does allow some room for our different degrees of conviction, by ascribing them entirely to various degrees in the uniformity of our experience, Dr. Whewell allows no such room, and thus puts it into Mr. Mill's power to use the very obvious argument, "as you show me what you mean by necessary truths, by adducing what is to me entirely contingent, I am quite justified in finding for them the same source, which is, on all hands, allowed to be sufficient for the latter." However, we have no business, at present, with the controversy between Mr. Mill and Dr. Whewell, to which we have alluded; it is not touched upon in the pamphlet on Induction, in which Mr. Mill's book on that subject is criticized and replied to; and only in connection with the inductive canons which Mr. Mill has reduced to system from Sir John Herschel's little book, will it be requisite to consider how far Mr. Mill has established a consistent theory of causation as their basis. These remarks have been made, however, to illustrate the degree of philosophical sensitiveness which we may expect to find in the minds of our authors. Dr.

Whewell's mind is better fitted, as it seems to us, for an inductive philosopher, than for a philosopher of induction; he examines mental processes as he would physical facts, and seems to aim only at giving an account which would *describe* them, not putting his mind *into* them to tell how they do really arise within; he regards them like an observer, *ab extra*, as needing classification and explanation, but does not take his own consciousness through the actual history of their formation, and so has no sensitiveness as to the different relations of kind, and internal authority, in which they stand to his own judgment. Mr. Mill's intellect, on the other hand, is one subtle enough in analysis, and that delights in deductive inference, but which can yield no belief to anything that is not capable either of direct perception, or of stringent deduction from facts of direct perception. He is inclined, therefore, to attribute any degree of influence to *known* causes, i. e. to facts capable of direct observation, rather than to assume any, even the slightest, cause, not capable of such perception, however perfectly it may account for the facts, and however disproportionate those facts may be to the hitherto observed results of any observed antecedents; in short, his tendency is rather to ascribe the very greatest degrees of influence to perceived causes, than the very smallest to those which are only assumed. Of this characteristic tendency in Mr. Mill's mind, his rejection of all *a priori* truth, his utilitarian creed in morals, his strong leaning to the doctrine that men's minds differ, *not* from different original constitution, but from the various influences to which they are subjected, and his remarks on Hypotheses, are perhaps sufficient indications. These remarks will make it clear why we cannot concur in Dr. Whewell's expectation that the Philosophy of Induction will become at all more lucid "in a controversial than in a didactic form," at least while the controversy is one between two minds so little able to catch each other's point of view; and while one of them monopolises nearly all the analytic power, so that he is confirmed rather than shaken in his own views by the learned, but ill-conceived, and ill-arranged objections of his opponent. In reviewing this controversy, therefore, we shall find it convenient to give first the theory of Mr. Mill, and in our review of that

theory to interweave the conflicting views (so far as they are systematic at all) maintained by Dr. Whewell.

At the very outset we are met with the question (so uniformly debated till a science has reached a very perfect state), what exactly are we to understand by the mental operation that is called Induction?—assuming meanwhile as a practical rule to guide us in seeking the answer to the question, that it is that operation (performed in all practical reasoning) by which we infer from particular data what is *not* contained either implicitly or explicitly therein, and what we cannot therefore arrive at by either deduction or analysis alone. Mr. Mill very properly therefore excludes from his definition of Induction, the formal syllogistic Induction, the ἐπαγωγὴ of Aristotle, which gives no new inference, but only predicates in a fresh proposition of a whole class, what has been predicated severally of each individual contained in that class,—and also the deductive mathematical processes (as the formation of new terms in a series according to the analogy of the old) which only assume the appearance of Induction from the omission of a demonstration which might be supplied (viz., that successive terms must follow each other, according to the same law). Mr. Mill then goes on to exclude a process from Induction proper, which he afterwards places amongst the operations subsidiary to Induction, the process of combining, through some essential property common to them all, the particular facts or data from which the inference is to be drawn. Thus, for example, that all the observed points in a planet's motion are points in an ellipse of which one focus would represent the position of the sun, is only a description of observed facts, obtained by comparing them with the relative calculated positions of points in an ellipse; and as there is no new inference made here, but only a comparison between facts deduced from the laws of a mathematical curve, with facts noted by observation, Mr. Mill rightly denies to such a process the name of Induction.* This is however violently contested

* We may note that there is no dispute between Mr. Mill and Dr. Whewell as to the conclusions that the remaining *unobserved* points of the planet's orbit would also coincide with the ellipse, and that the planet would continue to move in the same ellipse. These are of course strictly inductive inferences, but so obvious, that Kepler's discovery is scarcely thought of as including them.

by Dr. Whewell, who does not distinguish in any way this preliminary process, viz., the happy guess (suggested, no doubt, generally to a mind full of guiding analogies) which picks out the essential property that unites the particular facts, from the inferences which may be drawn from those facts. Now here, as elsewhere, Dr. Whewell betrays an entire inability to seize and hold fast the thought which alone can determine such a dispute. Induction is an inferential process. Is the introduced conception of the ellipse an *inference* or only a guess? Had Dr. Whewell seen the true point in debate, he might have maintained that the introduction of this new conception *might* at least have been an inference. Had Kepler, on examining the determined points in the orbit of Mars, reasoned with himself that he had formerly found similar relative distances in examining the relation of points known to belong to an ellipse, and so inferred that this curve might be itself an ellipse, the process would have been really inductive, an argument from that looser kind of induction that is called analogy, which, as Mr. Mill himself says, consists in the argument, "Two things resemble each other in one or more respects; a certain proposition is true of the one, therefore it is true of the other."—(C. xx. § 2.) So the inference in this case would have been in the form, "These distances resemble the distances I obtained previously for points similarly situated on a known curve. That curve was an ellipse, therefore this curve also may perhaps be an ellipse." Nor is there anything to prevent such an inferential process from being actually applied to obtain the true *description* of phenomena. When Snell was examining the relations of the angle of incidence to that of refraction, and endeavouring to determine their law of connection, he might very well have noticed that the variations in the angles of incidence and refraction resembled those in two angles of a triangle, whose opposite sides are varied so as to maintain a constant ratio to each other; and noting this resemblance, he might have been led to suggest as an hypothesis, that this would be the law describing the variations required; and such a process would have been analogical and therefore strictly inductive; "these variations remind me of certain others: those others were reducible to a certain rule, hence these

may perhaps be reduced to the same or a similar rule."* Mr. Mill would not, we are sure, deny to such a process as this, the name of Induction:—and this, or something of this sort, it is, which makes Dr. Whewell contend so strongly and strangely for the inductive nature of a mere guess; he feels that these tentative guesses *might* be suggested by analogical reasoning which would make the trial really an inductive inference; also that possibly this was really the case with Kepler† and other such discoverers of the true description of related phenomena, resulting in their reduction to a single class; and hence he has concluded that in all such cases, even where the process is purely tentative, the true description, when gained, must have been gained by induction.

But, says Dr. Whewell, Kepler "bound together particular observations of separate places of Mars by the notion, or, as I have called it, the *conception*, of an *ellipse* which was supplied by his own mind," and this, others, who knew the facts, could not do; therefore it was an Induction. Now suppose the trying an ellipse to have been purely a speculation, and not inferred from any conscious analogy with Kepler's former experience; what is the real process?—registered observations are compared with certain other known facts, and they are found to agree. The mental judgment that they *do* agree, is obviously deductive, not inductive. There is no inductive inference at all, unless the conjecture itself is no *guess*, but results from a real inference, which, though probable enough, Dr. Whewell nowhere asserts. He might say, indeed, none but a mathematician and an astronomer could have known *what* curves it would be useless to try, and what might be successful; therefore that it is not in any case a mere guess, but inferred from scientific experience; the determined

* This may have been the real process followed by Snell. He did not give the law of the sines, but "expresses the law in a geometrical form more simply."—*Whewell's History of Philosophy*, Vol. II. p. 503.

† That this might have been the case with Kepler, seems probable from what Dr. Whewell tells us in his *History of the Inductive Sciences*, Vol. I. p. 450: "When Kepler's first hypothesis was enveloped in the complex construction requisite to apply it to each point of the orbit, it was far more difficult to see where the error lay, and Kepler hit upon it only by noticing the *coincidence of certain numbers, which as he says raised him as if from sleep, and gave him a new light.*"

points might have belonged (as far as Kepler knew) to any one of certain curves, but to no others: then in such a case it may be admitted, that there might have been an inductive inference, viz., that the points would be found to belong to *one or other* of these curves. This inference however was not peculiar to the discoverer of the ellipse, but common to all the astronomers of his day: if to try the ellipse was a mere consequence of Kepler's determination to try all possibilities, till he found the truth,—then there was absolutely no *new inference* from the particular data at all (no induction) in the introduction of the conception of the ellipse, and the discovery was due to persevering labour, not to the application of an inductive process.

We may add that this mistake has no doubt been strengthened in Dr. Whewell's mind by neglecting to distinguish between the *unconscious suggestions*, and the *conscious inferences* that take place in every mind. The mere guess of Kepler, even though he could have assigned no analogy whatever for its probability, would be very different from the guess of any unscientific man. Still it would not be an induction, for induction implies conscious inference. This discussion would be of little importance in itself, did it not take up so large a portion of Dr. Whewell's very short reply to Mr. Mill, and did it not introduce a discussion, in which Mr. Mill seems to us to have involved himself and his science in some confusion. In reasoning against Dr. Whewell's doctrine, that the mere introduction of the new conception which binds together the phenomena into a single class is an act of Induction (an operation termed by Dr. Whewell, and, after him, by Mr. Mill, the colligation of facts), he uses an argument which, we think, Dr. Whewell rightly rejects as erroneous. As this is almost the only theoretical point which Dr. Whewell seems to us to have made good against Mr. Mill, and as it is in itself a point of some interest, we shall extract the whole of Dr. Whewell's reply.

"There is another argument which Mr. Mill employs, in order to show that there is a difference between mere colligation, which is Description, and induction in the more proper sense of the term. He notices with commendation a remark which I had made (i. 364, Mill's Logic), that at different stages of the progress of science, the

facts had been successfully connected by means of very different conceptions, while yet the later conceptions have not contradicted, but included, so far as they were true, the earlier; thus the ancient Greek representation of the motions of the planets by means of epicycles and eccentrics was to a certain degree of accuracy true, and is not negatived, though superseded by the modern representation of the planets as describing ellipses round the sun. And he then reasons that this, which is thus true of Descriptions, cannot be true of Inductions. He says (i. 367), 'Different descriptions therefore may be all true; but surely not different explanations.' He then notices the various explanations of the motions of the planets —the ancient doctrine, that they are moved by an inherent virtue; the Cartesian doctrine, that they are moved by impulse and by vortices; the Newtonian doctrine, that they are governed by a central force; and he adds, 'Can it be said of these, as it was said of the different descriptions, that they are all true as far as they go? Is it not true that one only can be true in any degree, and that the other two must be altogether false?' And to this questioning the history of science compels me to reply very distinctly and positively, in the way which Mr. Mill appears to think extravagant and absurd. I am obliged to say—Undoubtedly all these explanations *may* be true and consistent, and would be so if each had been followed out so as to show in what manner it could be made consistent with the facts. And this was in reality in a great measure done. The doctrine that the heavenly bodies were moved by vortices was successively modified, so that it came to coincide in its results with the doctrine of an inverse-quadratic centripetal force, as I have remarked in the History (B. VII. c. iii. § 3). When this point was reached, the vortex was merely a machinery, well or ill devised, for producing such a centripetal force, and therefore did not contradict the doctrine of a centripetal force. Newton himself does not appear to have been averse to explaining gravity by impulse. So little is it true that if one thing be true, the other must be false. The attempt to explain gravity by the impulse of streams of particles flowing through the universe in all directions, which I have mentioned in the Philosophy (B. III. c. ix. § 7), is so far from being inconsistent with the Newtonian theory, that it is founded entirely upon it. And even with regard to the doctrine that the Heavenly bodies move by an inherent virtue; if this doctrine had been maintained in any such way that it was brought to agree with the facts, the inherent virtue must have had its laws determined; and then it would have been found that the virtue had a reference to the central body; and so the 'inherent virtue' must have coincided in its effect with the Newtonian force; and then the two explanations would agree, except so far as the word 'inherent' was concerned. And if such a part of an earlier theory as this word *inherent* indicates is found to be untenable, it is of course rejected in

the transition to later and more exact theories, in Inductions of this kind, as well as in what Mr. Mill calls Descriptions. There is, therefore, still no validity discoverable in the distinction which Mr. Mill attempts to draw between 'descriptions' like Kepler's law of elliptical orbits, and the examples of induction."—P. 23, § 23.

Dr. Whewell is not very happy in making his own views clear to others at all, much less to an opponent who has the faculty of detecting the least looseness of expression in others, and then persuading himself, that all the difference of view may be referred to the confusion that such looseness implies; but we take it that what Dr. Whewell means to assert is substantially correct, and to this effect, that in all cases where we cannot witness to a cause by direct observation, but are obliged to extend its agency from known cases to unknown (as in the case of gravity), by reasoning from analogy, Induction can *never* give us *more* than the simplest explanation of phenomena, the simplest account of what *would* produce them, not what actually does. And when Mr. Mill asserts that it is and can be only a constant central force combined with an original force of projection, which keeps the planets in their orbits, all that he can possibly mean is, that the only way by which *we* could have created a machinery of that kind to go on *without our personal superintendence*, would have been, by tying a body to a fixed centre, and then projecting it *in vacuo;* but to apply such a theory to the system of the universe at large, necessarily assumes that force is really propagated without any active power beyond the first impulse, and this is, at least, clearly without proof. The first law of motion is true to us, as a law, but no one ever proved, or ever could prove, that motion *in vacuo* could continue uniform *ad infinitum*, without any agency beyond our own; and once admit that it is not so, that the constant propagation of force is due to a power constantly sustaining all the forces of the universe, and you admit at once, that our *modes of conceiving* the motion of the planets, though the simplest to us, are not either the simplest, or the necessary modes of actually maintaining them in their orbits to the creator and sustainer of all force: for, which would then be the simpler, to maintain constantly the uniform motion of projection, and the accelerating force of gravity at each point of

the planet's course, or to guide the planet (according to the same laws certainly, but) *without* any such resolution of effort in two distinct directions, through space? We put this case simply to show that Mr. Mill's assertions of these distinct forces as existing facts, is not only entirely unproved, but even unlikely, on the spiritual hypothesis of force; and, however lightly Mr. Mill may think of that hypothesis, he must at least admit that the mere *possibility* of an opposite belief at once reduces his high assertion of fact down to one of mere explanation. To us, indeed, it is inconceivable that dead force could continue unsupported for a moment beyond its creation, as we cannot even conceive of change or phenomena without the energy of a mind: we know the kind of reply that Mr. Mill would make to such a notion; we know that he would say in his majestic, judicial way—"Inquiries of this kind have no relation to Logic; they belong to the science of Transcendental Metaphysics; but I must renew my protest against adducing as proof of a fact in external nature, any necessity which the human mind may be conceived to be under, of believing in it." We shall hope hereafter to show that Mr. Mill *is* under the necessity that he so often and so authoritatively repudiates; but at present we are only concerned to show that he cannot establish any distinction between the case of *causal* explanation, and simple description, where the hypothetical cause or force cannot be separately observed. All that is *known* is, that the planets do move in ellipses round the sun; whether they do so by means of two distinct forces (capable of producing such a motion) or by means of a guiding power which results in the same visible orbit, Mr. Mill has no power to decide; and any other inductive explanation (such as Des Cartes's vortex) would be just as plausible as the Newtonian, did it give us as simple a mode of calculation, and contradict no observed phenomena.

Before proceeding to examine what the true ground of Induction is, we may remark that we think Mr. Mill has omitted to exclude one kind of Induction, improperly so called, from his scientific use of the word;—an omission which, more than any other cause, has tended both to confuse his own book, and to render still more mysterious to Dr. Whewell the precise nature of the inductive

inference, which he represents as so darkly thrust upon the mind: we mean that both Mr. Mill and Dr. Whewell, continually speak as if the mere *suggestion* of a cause or explanation to the mind, were an act of Induction. Dr. Whewell, indeed, at the beginning of his little reply to Mr. Mill, makes some very sensible remarks on the wide distinction between practical instincts and rational inference, and charges Mr. Mill (with some justice, we think) with confounding the two. Nevertheless, he himself is wholly unable to distinguish between the two; and while claiming Induction exclusively for speculative thought (which seems to us quite unwarranted,* as it is, beyond all question, the only ground of practical inference in common life), he often identifies it with the process of habitual association. When he calls the mere guess of a scientific man Induction, he merely confuses the effect of the law of association acting on a mind stored with analogies, with true inference justified by known analogies or observation itself. That Mr. Mill is not free from the same error, we may see by his speaking of the notion that eclipses were the forerunners of calamities, and several other mere cases of associated thoughts, as a kind of Induction; that it was a mere *suggestion* of the fearful superstitions of men, and not an *inference* of any sort, seems at least highly probable; and though, of course, the supposition is possible that some loose empirical connection was established, it seems unlikely and needless: and Mr. Mill would never have used such examples of insufficient generalizations,—where there is in truth no proper reasoning at all,—did not his theory oblige him to identify in their ultimate foundation, the associative and the reasoning faculty. This remark then, that no mere suggestion or association has any right to the name of *inference*, leads us to the discussion

* To say as Dr. Whewell does in this little pamphlet (p. 8, § 6)—"If from habit or practical skill, I make one billiard-ball strike another so as to produce the velocity which I wish, without knowing or thinking of the general law, the term Induction cannot rightly be applied,"—seems to us utterly untrue. By what are we taught to expect the common consequences of life, if not by Induction? Is it meant that a generically different process of mind is employed when a *physician* suspects poison from the same symptoms which suggests the same idea to another man, simply because the one is able to fill up the intervening links of causation between the action of the poison and the symptoms, while another concludes directly to the remoter cause? No assumption could be more unwarranted.

of the true basis on which our faculty of inductive reasoning rests.

Dr. Whewell has no view on this subject at all, so that we are fortunately saved the trouble of criticism. He gives us his last and most complete view of the inductive process in his Philosophy (Vol. II. Book xiii. c. i.), where he analyzes it into six processes,—(1) Decomposition of facts, (2) Measurement of phenomena, (3) Explication of Conceptions, (4) Induction of laws of phenomena, (5) Induction of Causes, (6) Application of Inductive discoveries. Of these, the first three are strictly processes subsidiary to Induction, and though containing excellent practical rules and helps, for observing and detecting the relations of phenomena, not touching the philosophical problem at all. And in the last three, he deliberately slips the act of Induction itself, neither asks after its ground nor its justification, and proceeds quietly to show that the cause or law inferred may be believed in provisionally, if it leads to true results; with more certainty, if it opens out new truths; and positively, if different effects lead up independently to the same hypothetical cause or explanation as the ground of each. This is the *whole* of Dr. Whewell's analysis of the mental process of Induction: he gives us his view indeed as to the origin of the principle of causation; but how he applies that view to visible antecedents, why we are to select any particular antecedent as cause, and what are the laws of right inference, he leaves so utterly unnoticed, that we do not suppose he had any misgiving that he had missed anything, or had anything to miss. Even this little pamphlet contains as much of the actual philosophy of Inductive science, as the two large volumes through which he so industriously hunts a system in the forlorn hope that something will turn up, but finds only history, and is obliged to content himself with noting what he finds in its original unanalyzed shape. It is curious how instinctively Dr. Whewell falls back upon the history of science, even while professing to unfold its rationale: with him it is the instinct of Genius; and we only regret that he so mistook his own powers, as to add so miserable a commentary as his Philosophy, to so great a work as his History of Inductive Science.

Mr. Mill's theory of Induction is shortly this. All in-

ference is inductive (deduction being only the interpretation of formulæ originally established by Induction), and is, in its ultimate nature, simply the result of past association. A is a mark of B, because A and B have been conjoined in our experience; that is, the one *suggests* the other. Reasoning therefore is always from particulars to particulars (so, however, that wherever one inference is warranted, a general inference as to a class resembling that particular in all essential respects, is equally warranted—thus, from the proposition, All our ancestors without exception have died, we infer that the Duke of Wellington will die, but have an equal right to infer that *any man*—i. e. that *all men*—now living will die); and hence, "nothing is required to render reasoning possible, except senses and association; senses, to perceive that two facts are conjoined; association, as the law by which one of these two facts raises up the idea of the other."—(Logic, Vol. II. Book iv. c. iii. § 3.) And the canon of probable inference, for no *certain* inference is, in the first instance, possible, which alone is applicable to all kinds and sorts of reasoning, especially the primary universal inferences, which *support* all strict laws of belief, is this—"Certain individuals have a given attribute; an individual or individuals resemble the former in certain other attributes; therefore they resemble them also in the given attribute."—(Vol. I. Book ii. c. iii. § 7.) To apply this theory to the establishment of any laws of reasoning, it is requisite to observe, that before any phenomenon *a*, we usually observe the same antecedent A, so that A becomes to us a sign of *a*, and when we see A, we *infer a*;—this was not always universally the case, so that there was a time when no one would have dared to assert that before any change, *a*, there must have been a uniform antecedent, A, of such a kind that whenever A had been seen, *a* might be *infallibly* predicted. But further observation has detected before *every* phenomenon that can be examined at all, some such unconditional antecedent, or at least traces of it, and if there had been any case where it was not so, we must have known it, because changes in every part of our universe have been observed every day since man was upon the earth, and never was it yet found [how could it have been *observed* even if it *had* really happened?] that there was a

phenomenon without such an antecedent as, if repeated, would be again followed by the same event. Hence, in the present state of the world at least, uniform and uncontradicted experience (which must, says Mr. Mill, have been contradicted, were there any experience of the opposite kind in existence) has shown us that where a change has happened, there has been some antecedent which would be invariably and unconditionally followed by that change; [*now any future change or phenomenon resembles all former changes in being a change (i. e. in one respect), therefore it (probably) resembles them also in this other respect, and will have some invariable and unconditional antecedent, i. e. will have a cause;] hence, the proposition that every change will have a cause (i. e. antecedent invariably and unconditionally followed by the same change), has the highest degree of certainty which human experience can give it.† This principle established, Mr. Mill deduces without difficulty his inductive canons; but we must pause to examine somewhat minutely the important step he has made.

The theory of inference here adopted by Mr. Mill, states that the mind is *carried on* in thought from the evidence, to the thing evidenced, that this is the whole and only operation: that if the mind be thus irresistibly carried on, the inference is certain; if only prominently, so that it remain partially open to different successions in its place, the inference is only probable; and that these different degrees of mental connection correspond to different numbers of repetitions in past experiences. What becomes then of Mr. Mill's lofty and reiterated censure of those who "adduce as evidence of the truth of fact in external nature any necessity that the human mind may be conceived to be under of believing it?" The law of association is simply and purely a necessity of the human mind, in reproducing and forcing upon it again, conjunctions which have once or oftener taken place within its observation, and any belief which rests upon this law, which expects a, after seeing A, because A and *a* have been previously connected in observation, does

* We put this in brackets because it is a link in the argument, apparently not supplied but only implied by Mr. Mill, yet obviously quite necessary to his reasoning.

† See Vol. I. Book iii. c. iii. and v.; and especially Vol. II. c. xxi.

not "adapt itself to the realities of things," but only to its own inward necessity. Mr. Mill entirely fails to point out any distinction between the law of association and any other laws of mind (proved to be such) justifying us in accepting the one as more *objective* than any other. A casual reader would be led to suppose, from his mode of writing in these and other places, that Mr. Mill had really dispensed with so ungrounded an hypothesis as laws of *mind* altogether, and had succeeded in identifying his mind, in every respect, with the outward world and its laws.—He might perhaps reply that the superior safety of the law of association lies *not* in its always ruling its expectations by past facts (which obviously need not necessarily be a good guide to the future), but in its self-verification in generally *coming out* right. But this must be the case with any law of evidence that could be shown to be even plausible, much more true; there is no question about inventing an imaginary law of evidence, but only about determining the true nature of the existing law: whatever it is, or has been, it must agree with the facts of human inference; and the point now at issue is *not* whether the associative law or any other law most accurately corresponds with the *facts* of human belief, but what reason Mr. Mill has for asserting that a law which *compels* us to expect the future to resemble the past, is, *per se*, in the least less liable to the charge of adducing subjective necessity as evidence for the truth of an objective fact, than any other law of mind whatever, whether *a priori* or otherwise. We are not at present arguing against the actual law assumed by Mr. Mill, but only against the unfair attempt to establish it, not by showing its more perfect agreement with the facts of belief, but by arbitrarily asserting, that it alone, of all laws, does not bring any internal necessity as evidence of an external truth. The attempt, so often made, to disclaim any law of belief different from those of external occurrence, could only come to disclaiming any possibility of belief not warranted by actual *observation*; so that no belief at all could be possible *before* an event: if the expectation of future facts is to be formed upon the experience of past facts, then this is, in itself, a law of mind, and of mind *only*, which brings as evidence of an outward fact "a necessity which the human mind is believed to be

under, of believing it;" and is therefore protested against by Mr. Mill.

We think then that we have proved that we may, or rather *must*, put faith in the laws of our own mind, whatever these may be, if we are to believe anything about future events at all, even of those of external nature; and that if Mr. Mill's protest is worth anything, it is directed against his own theory of evidence, quite as strongly as against any other. The next remark we have to make upon this rationale of the process of evidence, is, that its whole basis, viz. that every change has (to a moral certainty) an invariable and unconditional antecedent, i. e. one which will, in every case, be followed by the same change, is obviously founded on the theory of probabilities, and is, in truth, simply an application of that theory to a particular case. We have heard it asked why Mr. Mill has not put his chapter on Chances *before* his chapter on the ground of Induction; and certainly we found it on consideration quite impossible to explain. He would obviously have given much greater unity to his book by so doing, and would have relieved his readers of much of the mystification which we felt, when we were suddenly introduced to the law of universal causation, without a word of explanation about its evidence, except that it was a truth grounded on familiar observation. This of course assumes that observations of the past are (according to their degree of universality and familiarity) grounds of presumption for the future; but nowhere does Mr. Mill explain why this is the case, or even refer it explicitly to the law of association (except incidentally in a chapter of the Fourth Book quoted above, on operations subsidiary to Induction, when all the theory of the process itself is completed), nor does he explicitly refer his doctrine of probabilities to the same law, but only, in general terms, grounds them both on experience (or the absence of all experience).—Surely he ought to have considered and classed together our inferences from *uniform* or nearly uniform experience (moral certainty), and from occasional experience (moral probability); the law of causation, he says, rests on the one, and we therefore expect an invariable unconditional antecedent for every change with perfect confidence; but that does not alter the *principle* of our expectation, which is identical with that of a probable

guess; and no one who considers the question for a moment, will deny that Mr. Mill ought to have prefixed to his book on Induction, an analysis of the principle of expectation, and then immediately grounded upon this his doctrine of probability, of analogy, and of certainty; and so made us to understand *why* he considers the axiom of universal causation to be morally certain. Assuredly to have done so, would materially have altered the whole of his book on Induction. Let him once have stated clearly, that the association of A with *a*, in fact, is the only ground for our expecting its association in similar cases, and that the strength of such past association is a *minimum* measure of its probability in *every* case (though of course no *sufficient* measure where A can be shown to be related to *a*, as cause to effect, because then the special probability reaches the same certainty as the general truth that every change is preceded by some invariable and unconditional antecedent), and we should not have had the confusion, of founding the whole doctrine of chances and of causation upon analogy, and then making analogy to depend entirely upon causation. Certainly when we found Mr. Mill stating as the ultimate principle of all inference that because an individual resembles certain other individuals in some one or more ways, therefore it will resemble them also in other ways (which is the principle of analogy), we were not prepared to find him asserting that analogy is worthless, unless we have reason to suspect that the inferred resemblance is connected *by causation* with the perceived resemblance. Lest our readers should doubt that so clear-headed a writer could have so slighted and reversed his own theory, we quote his own words: he says,—

"We conclude that a fact *m*, known to be true of A, is more likely to be true of B, if B agrees with A in some of its properties (even though no connection is known to exist between *m* and these properties), than if no resemblance at all could be traced between B and any other thing known to possess the attribute *m*. To this argument it is of course [!] requisite, that the properties common to A with B shall be merely not known to be connected with *m*; they must not be properties known to be unconnected with it. If, either by processes of elimination, or by deduction from previous knowledge of the laws of the property in question, it can be concluded that they have nothing to do with *m*, the argument of analogy is put out of court. The sup-

position must be that *m* is an effect really dependent upon some property of A, but we know not upon which."—C. xx. § 2, Vol. II. p. 99.

In other words, the argument from analogy is good to prove the law of causation, to make us believe that, because we see the same consequents always following the same antecedents, it will be so in other cases also; but for any other purpose it must not be used for a moment. The association of phenomena is good ground for anticipating their association, while we keep within the sphere of causation; but once go beyond, and then the same association which was set up as a presumption for *all* unknown cases, loses its function, and becomes simply worthless. That which is Mr. Mill's ground for the doctrine of chances, upon which really the whole fabric of his system is built, ceases to be his ground directly he has got rid of the difficulty of establishing a fixed point from which to reason; and the old friend who relieved him, when in need, by lending him the whole of his logical capital, is cut directly he has provided himself with richer resources, and even talked of as a poor dependent. Surely Mr. Mill means to assert that constant experience in the past, is moral certainty for the future; and that frequent experience is moral probability, and that too, antecedent to *all* doctrine about causation (which is only established upon it). If this be the case, what right can he have to say subsequently, that such experience is no criterion whatever, *unless* there be reason to suspect causation? There *was* no reason to suspect causation in that mythical period (where does Mr. Mill place it? before the historical period? or even so late as the revival of learning?) of which he speaks when there was no conclusive reason to believe in causes at all; cause was an idea not then established, and as he says, all expectation must then have been formed from the induction *per enumerationem simplicem* merely, i. e. "because it does happen so in some cases, it will happen so in similar cases;" and this was the reason first for suspecting, then for expecting, lastly for believing, that all events would have invariable antecedents; surely this expectation was *rational* expectation?

Why Mr. Mill calls it "unreasoning" (Vol. II. p. 111, c. 21), when it has helped him to such a truth, we cannot

understand; for reason to be founded on unreason, is most paradoxical: and it seems to us sheer ingratitude to revile a principle to which he owes his logic itself. If this principle aided us before any proof of invariable laws at all, why then may it not guide us now, whenever those laws fail to help us? The doctrine of probability is entirely based on this principle, according to Mr. Mill (see pp. 78, 79, vol. ii.). There he is more consistent, not attributing, in words at least, our expectation to any guess at causes, but simply to an instinct that experience on the whole is uniform; why he should reject the same principle in the exactly similar case of analogy we are at a loss to say, except indeed on the hypothesis, that his doctrine of causation contains radical errors, which confuse him at every turn. The truth seems to be that Mr. Mill (like many other able reasoners, who so rejoice in their power of both analysis and deduction that they can never be at peace if they are asked to take anything as ultimate, and simply to have faith in it) is rather well pleased, we imagine, than otherwise, at the shadowy *basis* which he gives us for Inductive science. To use one of his own terms, he has more fitness for the Dynamics than for the Statics of philosophy, and delighting in *Inference*, feels the more at ease the further he can travel from the ἀρχὴ of his science. He congratulates himself that, while it has served his turn, it is quite useless for any other purpose, and is decidedly glad to be able to warn his readers against the loose habit of unscientific inference, to which he and all of us are, according to him, nevertheless indebted for the possibility of scientific rules. He evidently hates any unproved assumption as belonging to the sphere of transcendental metaphysics, a region which he regards with mingled dread and asperity, as a kind of scientific purgatory, that must be passed in order to reach the paradise of Reasoning; but to be shut out as soon as possible from the memory. Yet as he is too clear-sighted to think *all* can be proved, and nothing assumed, he trusts an original propensity of our nature for a while, only that he may dispense with it altogether, and thenceforth evidently owes it a grudge for ever having been necessary to him at all. We think, however, that this tendency of Mr. Mill to make the argument, from analogy (or what should be, with him, probable evi-

dence), depend wholly on causation, is not without foundation, though, in him, it is certainly inconsistent. As it is incumbent on us to suggest what seems a truer ground of induction, for that which we have criticised so freely in Mr. Mill, we will attempt to do so as shortly as possible.

We think, then, that it is a *necessary* part of the human mind to ascribe every change to an agency, power, or faculty, which is under the government of a will, just as our actions are produced by the exercise of volition, under the conditions prescribed by our limited powers: and that we are obliged to consider this producing agent as comprehending within itself the possibility of producing, under the same conditions, any number of similar changes; i. e. as *potentially* the cause of that change whenever the surrounding limits to its voluntary power remain equally unobstructive. Thus we regard the motion of a man's arm as always possible to his will, provided no stroke of paralysis confine more closely the limits within each volition is effective. We quite agree with Mr. Mill that *phenomenal* causes, i. e. invariable antecedents in the physical world, are not required by any necessity of thought, and that it is quite possible to conceive of a sidereal world, in which phenomena follow no fixed outward laws; but we believe that it is equally *impossible*, even for Mr. Mill, to conceive of *any* phenomena without a creating power that puts them forth, from a will conditioned by laws of its own. Thus, as far as induction goes, we seem to have no safer ground to stand upon than Mr. Mill, inasmuch as an inductive philosophy that is useless for physical inquiries, would be thought nearly futile. But this is surely not so. For once having a ground *within ourselves* (and we have shown, we think satisfactorily, that Mr. Mill has no better) to ascribe every change to a cause, and to assume the connected principle that the same force or energy acting under the same conditions must produce the same effect; and we have a right, or are at least warranted by a very high presumption (the grounds of which we shall presently discuss), in identifying the perceived forces and conditions which are uniformly followed by the same phenomena of nature, with those which we were obliged, by an intellectual necessity, to acknowledge. We use the word *energy* in the statement of this principle in order to reconcile the facts of mind and

matter; 'cause' in mind, usually expresses the faculty of will itself, whereas it is only the *effected* volition which, under the same conditions, is *necessarily* believed to be followed by the same effect. The will only contains the energy of volition potentially; it need not put it forth; but once put forth, and put forth under the same limiting conditions, the same effect *must* ensue. Force in nature is analogous to (as *we* believe, identical with) energy of mind; and of that alone, amongst actual phenomena, can we conceive as having any really effective, creative power. Force creating motion, changing direction, calling out resistance, is surely no mere antecedent or token of the phenomena which follow it, but their actual producing power. When, therefore, we can perceive uniform antecedents of force under certain constant conditions, preceding every external change, we are warranted in believing on very strong presumptive evidence that these are the very same constant and *efficient* antecedents to which a mental necessity carried our thought; though we had no right to expect *à priori* that they would be accessible to observation; and though we have still no mode of conceiving (because only the production, not the propagation, of force falls within our consciousness) *how* their effects are produced. That there *is* a necessary efficient energy, limited by constant conditions which produces always the same effect, we take to be an *à priori* truth, that all really accept, however they may seek to explain it away. That there is a phenomenal law of causation we take to be an empirical truth; but this once established, it is natural and obvious to identify the two, and to regard the energy which must have produced the change as really exhibiting itself in the forces and conditions observed to precede it.* And on this, and this alone, we conceive, can the true theory of probabilities be based. To that we must now turn, and inquire into the basis of presumption and probability, and see whether Mr. Mill's assumptions can give us any ground for a true theory of the subject. The most obvious principle of probabilities

* Of course, the supposition of efficient causation acting *through* phenomena, rather than in a parallel series *behind* them, does not in the least affect the question of miracle; energy, as the result of will, may cease or change in the line of phenomena, just as it might if each phenomenon arose by a distinct unconnected effort. It is not that the same causes produce different effects, but the causes are *not* the same.

from which we must begin, and one admitted in his second edition even by Mr. Mill, is that we ought not to expect anything without a reason for it; in other words, that expectation is governed by positive laws, and does not act at all without indications. This principle is used to establish the fundamental doctrine of chances, that in drawing from a box containing any number of balls, any one ball is equally likely, because we have no reason for expecting one more than another. The same principle establishes our right to identify (provisionally at least) the necessary efficient agencies conceived by the reason, and the observed antecedents of forces and conditions in the phenomenal world; we have no reason to believe in more than one such series,—we require evidence (subjective or objective) to believe that there are two, and no such evidence exists. This, then, at once warrants us in expecting the same consequents from the same observed antecedents. The negative principle of expectation, however, only determines our expectation when we are required to expect nothing; we must have a certainty added (as in the case of the balls in the box), that *something* will happen, before this principle gives us the right to expect any one thing at all. But when we come to the positive part of expectation, we assert that we require the doctrine of causation, and that no theory of probabilities can have a true or solid basis without it. We maintain that when we are entitled to expect an event, it is through our having more knowledge of causes in its favour than of causes against it, or some knowledge of the former with none of the latter; and that when we reason from an event that has happened to one like it, it is through the link of suspecting a common (or similar) cause, which entitles us to infer the same effect; and that the real distinction between knowing the *absolute* probability of an event (as distinguished from our presumption of it, which is generally only the result of *imperfect* indications), and knowing the event itself, is just this, that in the one case (of absolute probability) we know (and can estimate accurately) the power of those causes or conditions which tend to produce or to prevent it, but are ignorant of those which tend *equally* to produce and to prevent it (termed, therefore, with reference to the event, accidents), while in the other case (of absolute knowledge) we know the latter as well as

the former. This last remark gives the reason why choosing balls of different colours from a box, or throwing dice, are the cases taken as the types of mathematical probabilities, because the causes and conditions tending to produce or to prevent any single choice or throw are known; while all the other and unknown causes and conditions (the motions of the arm with the dice-box, or the blind choice of the hand in the box) are strictly accidental, i.e., tending equally to produce and to prevent any particular event; at one time to produce, at another to prevent, indifferently. To take then the simplest case first; what is the reason that, in a box where there are nine black balls and one white, we expect to draw a black ball nine times as much (in other words, nine times as *often*, frequency being the gauge of intensity in expectation) as a white? obviously because the local conditions* are nine times as favourable, because the hand may alight in nine places and get a black ball, while it can only alight in one place and find a white ball; just for the same reason that we do not expect to succeed in finding a friend in a crowd, the conditions in order that we and he should come together being many and difficult. This of course would not hold to the same extent were the white balls of smaller size than the black, neither would the probability remain the same; the larger ball would be much more likely to meet the hand. But the case more to our purpose, and which represents exactly Mr. Mill's theory (so far as it can be reached), is not that where we reason directly from known causes or conditions to the consequences, but when we pass from an effect to a similar effect (in which case, we believe that the mind always reverts to the cause, and passes from the cause to a similar effect). Bishop Butler puts the real question at issue when he remarks that a very weak presumption often repeated will amount to moral certainty. "Thus a man's having observed the ebb and flow of the tide to-day affords some sort of presumption, though the lowest possible, that it will happen again to-morrow; but the observation of

* We do not say "*causes*" for reasons we shall afterwards give. But if the word 'cause' be used generally, to include all the conditions, it would not be incorrect.

this event for so many days, and months, and ages together, as it has been observed by mankind, gives us a full assurance that it will." How Mr. Mill would resolve the difficulty as to the nature of this kind of inference we do not feel sure; whether causation depends upon probability, or probability on causation, or each on the other, according to his view, is not clear: we incline to the latter hypothesis, though it is not so certain that it is so here, as in the case of analogy. But certainly it would be most consistent with his theory of reasoning, from particular to particular, to suppose that he gives his judgment in favour of reasoning directly from effect to effect. Besides, analogy is identical with this kind of probability, and the only reason we have for not believing that he has identified analogical and probable inference, is, that he has given them a separate chapter. But no inference as to Mr. Mill's permanent opinion on this subject is more than a very weak presumption; and our own belief is, that in this book the principles of causation do the work, while experience gets the credit.

We believe that in the case mentioned by Butler, the rationale of the expectation is this; we refer the phenomenon of tides to a cause, and after the first happening feel some slight presumption that it will happen again, because we know that a power is in existence which *can* produce it, and therefore *may* produce it again, and *will* if the same conditions recur (on the principle that the same cause or force acting on the same conditions produce the same effect). If this be not so, why do we feel so much more probability added by the *first* instance than by any *single* subsequent instance? why—except that the first instance gives us its possibility (a cause *adequate* to it), while every other only gives us the frequency of its conditions? If no reference to a cause be supposed, *possibility* would have no meaning; yet it is clear, that, antecedent to its happening, we might have supposed the event impossible, i.e., have believed that there was no physical energy really existing in the world equal to producing it: the word 'impossible' does not seem to us susceptible of any meaning, if the reference to a cause be denied; it could only mean that it 'never actually would happen,' which certainly might be supposed, but is not equivalent to

the other, though it is the only meaning that the phenomenal school of philosophy can give to the word.* In truth, were it possible to conceive of events happening without any cause or effective antecedents, we do not believe that any expectation about their repetition could be formed at all: there might indeed be the mere associative suggestion, but nothing that could make us really look out for it, because it could tell us of no 'why' for our doubts, and yet could not overrule them, as a necessary condition of thinking at all. While we regard a phenomenon as a loose stray event happening independently *in vacuo*, leading our thoughts to nothing else, however often it may thus please to straggle in upon us, we can form no expectation about it; but once regard it as a proceeding from a constant cause, and we immediately feel that it has a hidden root in existence, which may again put forth signs of life. After the first time of happening, which is, then, more important to the whole probability than any other single instance (because proving the possibility), the *number* of times becomes important as an index to the intensity or extent of the cause, and its independence of any particular time. If we took the case of a tremendous leap for instance, and wished to form an estimate of the probability of its succeeding a certain number of times; the first instance, by showing its possibility (before doubtful), is of the most importance; but every succeeding leap shows the power to be more perfectly under control, greater and more invariable, and so increases the probability; and no one would think of reasoning in this case straight from one instance to the next, without referring to the physical energy which each leap indicated. Is it not then clear that we do not ever conclude directly from the happening of an event to the probability of its happening again; but that we refer to the cause, regarding the past cases as an index to the cause, and the cause as our guide to the future?†

* Mr. Mill uses the word 'impossible' in the sense of 'opposed to a rigorous induction.' How any induction depending *originally* on an *Inductio per enumerationem simplicem*, could be rigorous enough to render a simple fact carefully attested *impossible*, it is difficult to see.

† Besides this, Mr. Mill's method (see Vol. II. c. xviii. p. 78), of obtaining the chance, by comparing the cases in which the event occurs, and those in which it does not occur, and regarding the numbers so found as the ratio of the chances of success and failure, would generally be wholly erroneous. It

We believe then that we have established that the theory of probabilities really depends on the two principles of causation, and with it all the inference of common life, which is merely probable inference without any help from actual calculation. When Newton concluded that because the diamond had a high refracting power, it was combustible, he guessed that those qualities would not be so often seen together, were they not connected by causation; in fact, that the refracting power was caused by something which also produced the property of combustion. If it be said, that while we refuse to admit the phenomena of yesterday as evidence for the phenomena of to-day, we yet admit the causes of yesterday as evidence for the causes of to-day; we reply that the difference is this,—the phenomenon is passed, and directly it is passed it is evidence for nothing, it is a thing no more; but the cause or force is by its very conception something that does not pass away without a counteracting force, or the withdrawal of the energy hitherto exercised, and such events we have no ground to expect; the same principle that prevents us from expecting a cause or an event without a reason, prevents us from expecting a *change* in an existing cause without a reason for it: the existing energies that produce phenomena, we expect to exist till some proof is given to the contrary; the phenomena themselves give us their own reason for not expecting them; they leave us.—When the planet changes its place in the ellipse, we do not expect it, on account of

is not the *true* theory of probability. This would regard an event as *certain* which had hitherto never failed, which is exceedingly far from the truth, even for a very large number of constant successes. The true mode of obtaining the probability from past experience, is to assume that the *antecedent probability* (before the happening) might have been anything between 0 and 1, say θ, then to calculate the chance that it has happened as it actually has, *in consequence of this particular* chance θ, from that to calculate the probability that it will happen for the given number of times in *future*, in consequence of this particular chance, (here is *assumed* that the same causes produce the same effects,) and then to sum all the chances so obtained between the values $\theta = 0$, and $\theta = 1$, since the whole chance of getting this result will be the sum of all the chances of getting it from any one of the possible antecedent chances. Now in this process, what does the *antecedent* probability of an event's happening, which has never happened before, denote?—unless it be the degree of expectation that a mind ought to have felt that could have contemplated the *causes* in favour of and against the event, without those which tend equally to produce either. It *had* a probability, before it had ever happened, and this *could* only depend on the cause. The assumption of an *antecedent* probability involves therefore the conception of a cause.

its having had that position, ever to return to it again; that position is gone, apparently for ever, and we require positive evidence to expect it to return, which we get when we know the law of the cause or force, which never passes away, and which therefore only positive evidence could induce us to suppose gone.

In this discussion we have often assumed that cause means the whole assemblage of cause and conditions, but we have said that we believed cause and condition to be distinct. This is entirely denied by Mr. Mill, but, we think, on no sufficient grounds. The cause seems to us to be the active, the conditions the limiting or restraining element in producing phenomena. Mr. Mill argues, that what is called cause in one case is called condition in another, and adduces as instances cases in physical nature, when the confusion arises from not being able to say what is the active, and what the passive antecedents of the phenomenon, from the external position in which our mind stands to all the events of the phenomenal world. The true type of cause and condition is *will* and reasons (or purposes) in the mind; that which actually produces the effect, and that without which it would *not* so produce it (ἄλλο μέν τι ἐστι τὸ αἴτιον τῷ ὄντι, ἄλλο δ' ἐκεῖνο, ἄνευ οὗ τὸ αἴτιον οὐκ ἂν ποτ' εἴη αἰτιόν*). But to take Mr. Mill on his own ground: even in external nature, we always apply the word 'cause' rather to that element in the antecedents which exercises *force*, and which would *tend* at all times to produce the same or a similar effect to that which, under certain conditions, it would actually produce. In Mr. Mill's case of a stone falling into a well, the force of gravity is thought of as the real cause, while the presence of the stone within the region where the earth's attraction is the strongest force, is the local *condition* of the event. Mr. Mill complicates the question by asking at the same time for the cause of more changes than one. One phenomenon requires a cause and conditions; but when we take a great number at once, there naturally is no possibility of picking out *the* cause, unless we choose, like Mr. Mill, to keep the word 'cause' for the *whole* assemblage of invariable antecedents (which is certainly a convenient use of it in Logic, as it is that only which we can

* Plato, Phædo, 99 B.

ascertain by the inductive canons). But when Mr. Mill asks for the cause, when a death takes place from eating unwholesome food, and decides that the cause is the whole assemblage of conditions of eating the food, combined with *particular* constitution, and state of the atmosphere, why does he not add the conditions of having bodily organs at all, of the existence of the food, &c., &c.? These things are all connected through causation; but so many causes combine, that it would be useless to require *the* cause at such a distance from the effect; but this may be noted, that no one would ever call the existence of bodily organs the cause, simply because that has no *tendency* to produce the effect, though it is a necessary condition of it. Such cases are unfair, and only complicate the question; that we do really reserve the word and the idea 'cause' for active force, wherever that element can be detected and separated, is clear enough; the reason that in physical science this is so difficult to do, is, that *all* matter is probably resolvable into force, so that there is no phenomenon physically *caused* which is not the result of conflicting forces, and we can only select the one whose tendency is most obvious to produce the phenomenon; but there are some conditions absolutely passive, and yet absolutely necessary to physical phenomena, viz., the *relations of space and time*; and to these no one ever applies the word 'cause' without being immediately corrected by those who hear him. Thus if any one says, "the cause of an eclipse is, that the moon is in the plane of the ecliptic," every one feels that he should have said "the condition;" it was a condition absolutely necessary, but utterly ineffective and passive, and is never considered a cause. Whereas if any one said that "the cause of an eclipse is the shadow thrown by the earth," or 'the opacity of the earth,' that, being regarded as the really active element in *resisting* in some way the passage of light, no one feels the incorrectness of the phrase; and yet the passive condition is quite as *necessary* to the event as the active obstruction. So, too, every one would feel Mr. Mill's example, that "the cause of a surprise was the sentinel's being off his post," as incorrect; the allurement or force which *drew* him off his post, might be so called, because in doing so it removed a resisting power which would have prevented the surprise: but by common

consent 'cause' is always reserved for the active element, or the prominently active element, in producing an effect; and in matters of personal causation, mental or physical, where the consciousness of effort comes home, no one ever misapplies the term to the passive conditions; no one calls the *cause* of a leap the muscles or sinews of the body, though they are necessary conditions; nor the cause of a self-sacrifice, the knowledge which was necessary to it; nor the cause of writing a book, that a man has time for it (which is a necessary condition); there is quite enough consent amongst men in their employment of the term, to prove that it does denote a distinct element, the active element in the production of phenomena; and its misapplication in physical nature is easily accounted for by the impossibility of being able to perceive or understand the active element in processes quite external to our own consciousness.

But we must hasten to draw this prolix discussion to an end. Differing thus entirely with Mr. Mill as to the rationale of the inductive process, the grounds of inductive inference, and the facts of consciousness which we express by expectation, or probability, we agree entirely with him (if he really intends that this is the basis of his whole work) that the ascertainment of a cause (in the sense of the whole assemblage of active and passive conditions) is grounded entirely on probability, because the assumption that there will always be invariable phenomenal antecedents at all, is one of no necessary kind.* True, we believe that probability itself rests in our minds on the faith in efficient causes, and is only the state of mind in which we perceive the traces of causes more or less frequent in their operation; but the induction of phenomenal causes rests entirely on the grounds of probability, joined with the natural presumption (valid till anything is proved to the contrary) that these are themselves the real efficient energies.

Once having passed the establishment of the fundamental

* *Assuming* the doctrine of efficient causes, we might easily calculate the probability for uniform physical antecedents from the observed uniformity now established: but without this assumption this is impossible, as the calculation itself involves the principle that the same causes produce the same effects.

principle of Induction, the theory becomes simple enough, and the practical applications only are difficult. All the rest of the process consists in observing or obtaining the causes supposed to be possible, and excluding (as at least not *complete* causes, in the larger sense) those which are not followed by the phenomenon, and retaining (as at least necessary conditions) those whose removal is followed immediately by the disappearance of the phenomenon; and when these methods will not apply, success may be obtained by observing the changes in antecedents which accompany the changes in consequents (on the principle that an effect cannot vary without a variation in its cause, so that anything which remains entirely unchanged while the phenomenon varies cannot be its whole cause, at least), or by removing known causes, and then effects, in order to reach more clearly the unknown residual cause. The theory of this part of the subject is stated clearly; and even if not systematized into the most symmetrical form, yet it is given much more systematically by Mr. Mill than had been previously done. The method of residues might perhaps have been left to enumerations of practically useful rules, like those of Dr. Whewell; there is nothing peculiar to it depending on the theoretical definition of cause, and it may be classed among the contrivances for simplifying and resolving the phenomena to be observed. Dr. Whewell criticizes Mr. Mill's *examples* with much severity, and probably not without some reason: but this does not affect the theory, which is independent of such examples, being the true rationale of operations which Dr. Whewell and every one else performs every day in judging of the matters of common life.

We must notice one point more before we conclude. Dr. Whewell and Mr. Mill are at variance as to the function of Deduction in the future history of physical science, but they both agree to maintain that deduction alone is likely to effect much in the further progress of the moral sciences, on the ground that we have arrived already at the highest generalizations of these sciences. We confess that we look on such an opinion with extreme astonishment. In political economy indeed, this is certainly true; but in psychology, ethics, and religious philosophy, we confess that we should scarcely expect such an opinion, from any

thinker, except one who believed in the omnipotence of the laws of association, the results of Scotch analysis, or the philosophy of a Bridgewater treatise. The great failure of these sciences has been mainly owing to the difficulty of seizing fast the living phenomena of mind before they vanish, leaving only faint heavy traces on the memory; this recommendation encourages the disposition to avoid this difficulty by accepting the old rough generalizations, which would only represent the shadows of mental phenomena, and using them to deduce tight sharp systems, which (like that of the late Mr. Mill) manage to explain a small portion of our experience, by declining to believe in the greater part of it altogether. In the physical sciences it is the ascertainment of the probable cause which is difficult; the process of verification by comparison with the results of empirical laws is easy and definite: we know clearly what facts ought to be deduced, and how far they do correspond with the results of theory. The difference in the case of the mental and moral sciences is one worthy of note, and suggests we believe the true solution of Dr. Whewell's difficulty (so strangely solved in his book by quietly re-stating it in another shape) as to why the Greeks failed so entirely in physical science. That it was not anything inherent in the inductive process is evident enough; they reasoned with all the practical skill of a cultivated nation, and all practical inference involves the inductive process. Besides, as Dr. Whewell says, they observed facts accurately, and classed them with judgment: and Plato's inductions as to the meanings of words are excellent specimens of the most perfect inductions. But their stumbling-block was one as to the *nature* of the evidence they had to expect for their conviction. Accustomed to the inductions of mental science,—where no cause could even be suggested that did not contain something capable of deduction into a very *similar* effect, where the *probability* of a suggestion was seen even before it could be thrown out at all, and the mind knew before it began its search what *kind of cause* it must look for,—they looked out for the same kind of evidence for a physical cause before they even thought of trying it, and expected to find some evidence in a mental comparison, although neither the operation of the cause nor the nature of the effect were acces-

sible to their consciousness: they had not seized the idea that they must not expect to understand the *processes* of outward causes, but only to know their results; and consequently the whole physical philosophy of the Greeks was an attempt to *identify mentally* the effect with its cause, to feel often some not only necessary but *natural* connection, where they meant by *natural*, that which would, *per se*, carry some presumption to their own mind, as the suggestion of mental causes for mental effects were accustomed to do. They wanted to see some *reason* why the physical antecedent should produce this particular consequent, and their only attempts were in directions where they could find such reasons. Thus all the Greek physical philosophy began by assuming that all changes were only alterations of form, not of substance, and attempting to indicate them by something which professed to detect the same elements in different disguises, or the same atoms in different local positions. They could not enter into the mode of real change, and so they disbelieved it; their theories, such as they are, all strive to render obvious at once to the mind the kind of connection between cause and effect. The Pythagoreans detected mathematical analogies; Plato, mathematical and moral; the Ionians one single, all-pervading, physical principle; and others the local changes of eternal atoms; and even Aristotle gropes after phrases for physical facts (as 'natural' and 'violent,' &c.), which may help to convey a kind of factitious mental authority, from their associations with mental experience. It was the necessary absence of this kind of evidence in physical inquiries, we think, which so long shut out the Greeks from our physical knowledge; and it is perhaps the presence of this kind of evidence in mental inquiries, that keeps our moral sciences so backward, while the physical have gained so much. Accustomed to find verification easy and safe for physical inductions, and the induction of causes difficult, we are at once misled by the *prima facie* plausibility of the inductions of mental science, and by the *apparent* agreements of deduction with empirical law; quite forgetting that a much more stringent comparison is needed in mental phenomena to *identify* a result of theory with a fact of consciousness than is requisite in physical science. In truth, the question of *resemblance*

between the result of theory and fact must generally be at rest even before the hypothesis is hazarded, and the only question is as to *identity*, which in this case is very difficult to decide. It seems to us that there is no branch of science where the inductive process is so requisite, where so much care is required in grasping the true phenomenon to be accounted for, unmutilated and unchanged, and where there is so much difficulty in doing it, as that of mental and moral philosophy: since here the deductive process, which generally keeps off erroneous conclusions in other inquiries, is but little safeguard. This decision of Mr. Mill, as to the future progress of mental sciences, is more inconsistent in him, because he takes a very high ground, not, we think, always tenable, as to the tests of hypotheses. He says (Vol. II. c. xiv. p. 23) of a hypothetical law, that it is no argument whatever in favour of it that it should predict new results, before unknown, which turn out to be true; because if the analogy extends far enough to warrant its assumption at all, it is almost equally likely to extend further than at first perceived, and suggest new truths. What is here said as to a hypothetical law is equally true of a law established by induction, if that induction be insufficient and be applied to cases quite different from those for which it was made; and this is the case, as it seems to us, with almost all the generalizations of our present psychology; moreover, the test of predicting *new* truths by deduction is one scarcely applicable to a science of human nature, where almost all truths are empirical long before they are deduced, and where artificial experiment for peculiar cases is quite impossible.

Here we must bring this very insufficient though lengthened survey of some of the principal questions of Inductive Philosophy to a conclusion. It is a somewhat presumptuous, and not an easy task, to criticise so able a thinker as Mr. Mill, especially when his writings appear to have quite subdued the not very independent spirit of English philosophy. The prolonged silence with which his book has been received by English critics seems to imply a surrender without terms; and in fact the qualities of Mr. Mill's mind are eminently calculated to impress and frighten our countrymen into silence, even when unconvinced. The dread of mysticism in this country, or even of the mere

imputation of assuming anything that is not capable of proof, is almost morbid, and Mr. Mill's quiet contempt for any superfluity of belief is likely enough to intimidate, even where his arguments do not overwhelm. And in truth even the extreme of incredulity is more tolerable in philosophy than the tendency to admit without the strictest examination, as foreign philosophers so often do, that any psychological fact is ultimate. Still the theoretical results of the incredulous school are often more astonishing, and this, by far the ablest statement of what may be called the *multum-in-parvo* school of philosophy, constantly seems to us rather to create than deduce its conclusions. Valuable as Mr. Mill's book is, we do not think that even the Logic of Induction (by far its most important and, in our estimation, its least erroneous part) has received from him a really permanent form, since the principles of symmetric arrangement seldom or never reveal themselves, while the fundamental assumptions of a science remain erroneous or unfixed.

Art. V.—RECENT POETRY: KINGSLEY; TRENCH; BURBIDGE AND CLOUGH.

1. *The Saint's Tragedy, or the true Story of Elizabeth of Hungary, Landgravine of Thuringia, Saint of the Romish Calendar.* By Charles Kingsley, Jun., Rector of Eversley. With a Preface by Professor Maurice. London: John W. Parker, West Strand.

2. *The Story of Justin Martyr; Sabbation: and other Poems.* By Richard Chenevix Trench. London: Edward Moxon, Dover Street.

3. *Poems from Eastern Sources.* By Richard Chenevix Trench.

4. *Ambarvalia—Poems.* By Thomas Burbidge and Arthur H. Clough. London: Chapman and Hall, 186, Strand. F. Macpherson, Oxford.

It has always seemed to us an assertion the most false and untenable, that as science extends its discoveries, the province of poetry must contract. As the theology of some would rêduce the Deity to a great First Cause, not the immanent Spirit of all things,—would designate Him the original *Creator* rather than the all-*sustainer*,—and in every new-found law of the material world, find a fresh link in the tremendous chain that severs us from God Himself—the first of the great series—so the philosophy of others, following hard upon the same track, and by a mode of reasoning that we are unable to comprehend, has found likewise, in the increasing empire of scientific truth, a highway of banishment for the divine inspiration of the poet. What there can be in the recognition of a beautiful consistency, an harmonious order, characterizing this vast universe of nature as the natural expression of the changeless and ever-active will of the Great Supreme, to limit the sources or confine the action of poetic genius, we cannot even surmise, although we have often heard it confidently stated, that as Science advances, Poetry must retire; as the one spreads her dominion, the other must gradually

shrink away, till Science having acomplished her work, and revealed to the world every secret of creation, gazes over her vast domains, sole monarch of the mind—beholding not even the last point of space from which she has finally dislodged the spirit that once delighted and enraptured man. The theory seems to have arisen from an idea (partially true) that Poetry draws its vitality from the sphere of the *unknown*. Now though we believe that all the sublimest poetry of man *is* connected more or less with the mysterious, it is certainly not the case that all true poetry *must* owe its interest to its choice of topics above our human comprehension. There is a vast deal of descriptive poetry, of a high order, that concerns itself only with the beautiful things of this visible earth—hill and valley, and lake, and storm, curling vapour, and floating cloud—and though there should be a sense of the mysterious in the mind of the describing poet—a feeling of reverential wonder at the beauty or grandeur he would paint (the sources and continuous existence of which he cannot comprehend), still he is not necessarily conscious of this; at all events he does not necessarily give expression to the feeling, and as he deals with visual phenomena familiar to all, every one can see the power of the poet and the fidelity of his pen, and many would confess it who had no idea that there might be in his mind something more than a mere perception of the beautiful and sublime: there *might* be or there might *not*. The pleasure we derive from the purely descriptive poetry of Sir Walter Scott depends upon its faithfulness to the real beauties described, and perhaps to that infusion of the imaginative and the romantic, which leave the mind so much to fill up for itself; and though it may be said that his poems, like his stories, owe something of their interest to the author's love of the *marvellous*, it can hardly be maintained that he deals much with the *mysterious*. Byron, too, one of the most vivid describers of Nature's beautiful and sublime features that can be cited, deals for the most part directly with the known, the visible and tangible, and not with the hidden powers beyond our reach. How did advancing Science affect his genius? Would he have written more or better, had its discoveries been fewer? We can see no reason why. But then we confess we hold mere descriptive poetry to belong decidedly

to the lowest class, and it is certainly true that as we rise thence to a higher and a higher, we find ourselves approaching nearer and nearer to a conviction of the fact, that the poetical is largely based on the mysterious. At the same time, the truth is not one that will be always realised; for when we come to dramatic poetry, though now and then (as in the case of Hamlet) the mysteries of life are distinctly recognised, few would call the vivid delineation of fine characters by Shakspere or Schiller, poetry that dealt directly with the mysterious and unknown. We do not say that this opinion would be strictly correct; for in the play of human affections, in the fluctuation of human feelings, in the inconsistencies of human character, there lies as deep a mystery as can well be found. The life of the spirit is indeed a *hidden* life; but still this mystery is one with which all are so familiar, consciously or unconsciously, that if it is not brought prominently forward by the dramatist, his works are not supposed to depend for their interest and vitality on their reference to things unseen and unsearchable. Nor is it so, indeed, more than incidentally. He may take his observations entirely from without; his instincts may give him free admission into the characters of men, and though nothing is more strange and inexplicable than this intuitive sympathy, the mysterious means by which his knowledge was obtained does not necessarily impress his own mind, nor will it appear upon the face of his productions. Here then is poetry dealing with the actual and familiar, rather than with the mysterious and unknown; and yet this is one of the most fruitful spheres of exercise for the divine art, and though really concerned with the deep secrets of human nature, and setting forth the strange varieties of human thought and feeling, purpose and disposition, is, to all appearance, treating of those manifest relations of life which owe their interest, not to our ignorance of the laws of mind which the progress of metaphysical science has in some degree dispelled, and may dispel yet further, but to human sympathies and affections, which never change from age to age. When, therefore, it is said, that the existence of poetry is only compatible with limited knowledge, the statement can by no means receive our assent; for it seems to ignore the fact that half our finest Poets deal

with human character familiar to us all, and claim our attention through the universality of those elements of our nature, which they clothe in the beautiful garments of their inventive fancy. And what can science do here? It can never explain away the freedom of the human will, can never show us to be systematic pieces of mechanism, who are living voluntary agents, and, accordingly, the portraiture of man, with all his passions and wilfulness, his nobleness and sin, his joys and sorrows, his speculative thought and ardent sympathy, will remain for ever, and among all people, a subject of deep interest and profound study: and while the poet is penetrating the mysterious veil of the soul by a quick perception and ready experience, he may display his characters so completely in the true light of nature, as to leave no apprehension upon the reader's understanding of the mysteries which he grasps and rules: and though he is really treading in a land, the rise and growth of which he cannot possibly explain, still it cannot be called a land *unknown*, being, as it is, one which he has so carefully and so fully surveyed, though by means which he himself cannot comprehend. And, again, were the theory true that mystery must be the companion or nurse of poetry, the omniscient Creator, the great Ποιητης of the Universe, could claim no such title at all; and indeed, according to some, He is but a wondrous mechanician of surpassing science, who performs His great works by availing Himself of His perfect *knowledge* of the properties which He has Himself *invented*. We, however, are wont to look upon His creations as produced at the same moment, and by the same spontaneous exercise of volition, with which their coherent properties are first conceived. We are wont to regard the Deity as *the great and sublime poet*; for what is the bright vision of this earth's beauty but the glorious realization of His grand imaginative thought? and what are His diviner works—the spirits of heroes and of saints, but the expression of His pure desire and wakeful affection? what the great ideal of humanity himself, but the fulness of the Deity's conception and the offspring of His perfect love? And yet there can be no mystery with God. Poetry, therefore, which would seem to be, in all its higher phases, the expression of affections through the medium of imagination, *may* con-

cern itself with things intelligible and familiar, that lie immediately *within* the region of experience: it does not necessarily require the aid of mystery; and yet we freely confess, that the noblest strains of man are those in which he rises above the actual and demonstrable to the invisible and unknown.

Now because poetry and mystery are perceived to be often closely bound together, therefore it has been alleged that the ancients only (Homer and Hesiod, e. g.) could indulge their imaginations with full freedom and success;—that they could sing of the dusky air and the pure ether, as we cannot do, who are taught to think of the atmosphere as an elastic fluid, composed for the most part of nitrogen and oxygen, in the proportion of 79 to 21: that Horace or Virgil could celebrate with effect the wandering moon or stormy winds, a task impossible for us to undertake with advantage, who know all about them, since we are able to predict and explain the eclipses of the former and even to describe its interior, and to account for the incursions and changes of the latter by the processes of rarefaction and condensation. But surely if the poet can no longer indulge his fancy upon these themes,—in picturing, e. g., the earth's real shape and limits (now discovered), or in conceiving brilliant theories about the stars, and their relative positions, and modes and periods of revolution, his eye is but opened to a vaster region of the infinite mysteries around him, which the discovery of nature's secrets but enables him more keenly to discern. The old bards looked on earth and man with eyes unenlightened by the now explored wonders of creation, and the constantly increasing revelations to the wakeful soul, with which our modern poets *must* be familiar. The position from which inspired men of former times looked out upon the world, was certainly one girt closely with thick clouds and dense mists, which we may say have now been swept away; but if those clouds and mists once precluded the possibility of man's perceiving the *law* and *system* of the universe (unfavourable to poetry), of which *we* of the present day have become conscious, they also must have disabled him from perceiving, or even surmising, the power and grandeur of creation, and the vast infinitude of that realm of mystery beneath which he stood. The region of the unknown

being boundless, the changing of the point of sight of different generations can but alter the quality of their wonder and observations, and leave them still but as insect-spirits on the ocean's verge.—Indeed, so far are we from thinking that there is any truth in the idea that there is less room for poetry now than formerly, that we entertain a strong and vivid hope, nay a lively trust, that the coming ages will give to the world strains of inspiration such as Homer never sung, nor Dante wrote, nor Milton dictated in his most rapt and elevated hour. The more that man discovers thoughtfully, the more does he become conscious of the height, and breadth, and depth of being, through which no eye or penetrating mind can measure the infinitude of Deity. The further the ages bear us, the more light that is poured upon us from the growing past, just so much the more is the mind lifted up by cultivation and refinement, reading, and study and expanding wisdom, to see the smallness of visible realities, and the immensity of the unsearchable dwelling-place of God. It is assuredly the narrow and material mind that sees in the increase of our learned expositions of the congruities and consistencies and possible scheme of created things (and our science is nothing more than this) the encroaching limits of all truth.

Paley, in the utilitarian spirit of his age, could see the revelation of a God only in the recognition of contrivance and the adaptation of means to an end: he did not see that the existence of a supreme mind was still more simply shown by the evidence in creation of that same love of beauty, and order, and general harmony, which is an instinctive property of the human soul. His arguments were framed to answer the *cui bono* question characteristic of his time and (alas!) of our own also; and in the same spirit it has been reasoned, that, according as we can carry our answers to this question further and further into the visible creation, is there less and less scope remaining for the play of the imagination, the materials of the poet becoming rapidly extinct. Now we believe that this view is decidedly false. His themes naturally change their character, but become neither narrower in extent nor of a lower order; on the contrary, we believe that they become continually more and more elevated, and that far

from his being deprived of the ground upon which he stands, he is only removed a stage higher in the realm of thought, advanced another step through the daylight of wisdom, and another step into the dark cloud of unfathomable mystery.

The utilitarian habit of thought is the only real check upon the spirit of poetry in *any* age: had it pervaded Homer's country in his day, no rhapsodists would ever have preserved for us the Iliad or the Odyssey; the fact that little was known then of science, would in no way have assisted the lucubrations of genius when chilled by selfishness and bound down by mean ambition. Wherever is found a love of everything beautiful, and sublime, and pure, and good, for *its own sake*, and not because it is adapted to some rational purpose, and satisfies some definite earthly craving, there the spirit of the poet exists; and he who is inspired to weave the fair web of language into pictures, and arrange the rich notes of sound in the sweet lines of melody, failing not to do so, will find an eager response in many a breast. To our minds the theory we have been combating shows, in the first place, a strange blindness to the relation borne by humanity to the invisible world so vast and so mysterious, and also entirely ignores the action of the Deity upon the soul, which is ever constant, belonging as much to later as to earlier times; for it is by His immediate inspiration, we believe, that the poet, acting ordinarily by the influence of the Deity, though sometimes more peculiarly visited by the divine afflatus, alike with the musician and the religious teacher, and every good and earnest man, expresses himself with rare and signal success. And who shall say that when our scientific research has reached its *ultima Thule* (if the time should ever come), poets shall cease to be, not because the universal Father can no longer inspire men, but because subjects and materials will be wanting for the exercise of such inspiration? In this mechanical, matter-of-fact age of toil and acquisition, beneath the tyranny of material things, we lose sight of the sublime mysteries that encompass all mortal life, overshadowing the present time and veiling the dim lights that shoot their fitful gleams into the future: and we forget that this must ever be; that the very constitution of finite natures implies the

necessity of an ignorances ever during, that can only shift its ground. Let the mo t practical man in the world reflect for awhile upon his powers, origin and destiny; let him ask himself what his nature is,—how he exists,—whence he came,—and whither he is going,—and in what all his eager pursuits for wealth or comfort, enjoyment or reputation, will really end? how far his calculations of profit and loss, of to-day's receipts and to-morrow's expenditure, will turn to account, when he feels his spirit throwing off its mortal coil? and he *must* become conscious that the realities about him, which he holds at so high a value, —contemplated, it may be, under the calm eye of evening, or the serene brow of night,—when earth shrinks into its hollow shell, and eternity presses on the living soul and expands before the upturned gaze,—are as the dust upon the whirlwind,—or the shadows of summer clouds, the most insignificant semblances of things, and no veritable realities at all. While, then, our spirits move through this vast sphere of the unfathomable, and we cannot learn by what means or to what issue our struggling wills, and strange fortunes, and soaring hopes, and deep affections, bear us through the labyrinth of life,—surely the truth contained in the theory that poetry exists only where mystery is found, *corroborates* instead of disproving the fact, that we may look for poets in the present and the future, as well as in the past. So long as the landscapes of earth and the colours of air, the everlasting play of ocean and the serene deeps of the firmament, still retain the eternal traces of majesty or beauty, grace or grandeur, given them by the creative thought of the Almighty, and so long as man,—awake to a lively and grateful perception of these phenomena of the supreme will, can combine with his impression of their glory, the tale of his *human* experience,—those far deeper interests which concern the soul on its mysterious transit from silence again to silence,—the day of the poet can never wane. Fancy and Imagination have materials enough for whole cycles of centuries; Thought and Faith will always find things new and old to furnish subject for the poet's contemplation; and till Enthusiasm be quenched, and Love grow cold, there will be well-springs —fresh and deep—of poetic inspiration, to carry on the solemn symphony of the ancient world, and fill up the

pauses of toil and prayer, with melodious music and sweet praise.

But more than this, as a matter of fact, we ask, is not our modern poetry finer than that of the classic world? With all Homer's beautiful descriptions and rugged power, is his kind of poetry comparable with that of Milton? Or can you place the solemn pictures of Æschylus beside the grand and beautiful realities of Shakspere? Tasso and Virgil may bear comparison, but then their ages are not so widely sundered. Taste, however, must decide these matters perhaps, and criticism will then be silenced.

It may be urged, however, against modern poetry, that it is obliged to seek for themes not belonging to it at all, and like the old Dutch painters, shows us the commonest utensils of the home, and the ugliest and oldest forms of human life, and demands our praise because of the skill of the representation. But this is to judge poetry by the eccentricities of poets, or the rhyming propensities of writers who are not poets at all, instead of by the manifest materials at the poet's command, and the capacities of real genius, and the inspirations of God. Because poets will stoop from their own natural sphere, and, having taken up some theory respecting their art, endeavour to prove its soundness, by giving to the world a flood of effusions only fit for the nursery, in which we suppose they find a beauty that none else can see,—we do not recognise in this anything more than a perversion of the poet's aim. Beauty and sublimity are *not* ubiquitous; and if men, whose power it is to present these as they really exist, and draw them into view when they would otherwise escape notice, *will* endeavour to *make* them, or to conceive them present, where they do *not* exist, sentimentality or childish prose must be the result. Poetry cannot be written *upon a theory* by the efforts of the will; and wherever the experiment has been tried, it has signally failed. But surely because Wordsworth has written much doggerel, and Tennyson not entirely free from affectation, it does not follow that the resources of the poet in the present day are few and unfruitful; those two just named are noble examples to the contrary. For our own parts, putting the drama aside, with the exception of old Chaucer and Spenser, and our great epic poet, we find all our best works to be of

strictly modern date. What were Butler, Waller, Dryden, Addison, Pope, Johnson, Shenstone, or Akenside? Some of them admirable satirists, but hardly poets any of them, though correct metrical writers? Dyer, Gray, Collins, and Thomson, claim a higher rank, the first two especially. There must be an enthusiasm, a glow, an affluence of beautiful thought, and fancy, and feeling; to make a poet. Verse-writing and metre-measuring do not constitute the divine work. Prose-writing has often far more true poetry in it, than whole volumes of Pope or Dryden. Two qualifications are essential to the poet—fulness of thought, imagination, fancy, feeling; and freedom of harmonious expression. The putting rhymes together with some taste may be done by almost any lady of leisure as a pastime for the drawing-room. It is quite another thing to conceive and write what shall be true poetry. The conceiving and the expressing faculty, we say, are both requisite. In the highest poets they are wonderfully combined. In prose writers too, as they are termed, because there is no metrical arrangement of their words and sentences, we often find these combined faculties in great perfection. Many passages, e. g. from Mr. Ruskin's works, are in the highest sense poetical, the most beautiful and choice language being employed to express grand ideas with exquisite imagery. And yet this is called prose, and Hudibras, and the Pleasures of Imagination, and the Essay on Man, poetry. We wish some new classification, and new terms, could be introduced, giving its proper rank to poetical prose, and sinking to its proper level mere metrical composition, animated by no genius of the really poetical cast.

We have heard it maintained that poets may exist without any power of expression whatever: this we hold to be simply a contradiction in terms, because the mastery of language is so essential a part of the poetical faculty, that we include it in our definition of a poet. How is *prose* made poetical, but by the writer's possession of this same talent for giving choice words to his ideas? Many a person, doubtless, has a vague sensitiveness to the beauty, harmony, or sublime character of things around him, or of the human relations in which he stands;—and because he can find no words in which to embody this sensitive apprehension, he flatters himself he is a poet without words. Why, if this feel-

ing ceased to be *vague*, grew into a full conception, fed by the fire and genius within, words *would* be found, and according as they were adequate or inadequate to realize the full feeling and thought labouring within, would the poet be deemed able or otherwise. Doubtless these faculties exist in very different proportions in ordinary minds. Of men, equally poetically constituted in thought, imagination, affection, and so forth, some will be able readily to express in suitable language the most commonplace ideas, while others cannot well express the most profound or beautiful. But it *generally* happens, we believe, that the two faculties go together in very equal proportions, so that in the great majority of cases it will prove true, that of any given number of men, he who expresses himself in prose or verse with the most facility and beauty, has in other respects the most poetical temperament. If a man be a true poet in power, and vividness, and depth, and beauty, of feeling and conception, we hold that he will not remain obscure, from want of ability to use that mother-tongue which in childhood we find it so easy to acquire. The singular power of Byron to fuse his ideas into language—the very living representative of his thought, is certainly given to few; but when we see writers (like Miss Barrett, now Mrs. Browning, e. g.) to whom feelings, ideas and imaginations seem much more abundantly supplied than words, still succeeding in giving an expression, albeit not the best, to their thoughts, and showing us their minds in their books, we are not disposed to believe in a hypothetical class of dumb poets. This century, at all events, has had a large share of eloquent speech from many melodious voices. And if our own generation *is* grown somewhat cold and worldly, still the soul and the voice of the poet have not yet vanished from the midst of us. The real check upon the poetical spirit of an age is the tyranny of mere formal conventionalism, hollow pretence, and mammon-worship, which have somewhat signalized our times, and which our modern prophets are everywhere inveighing against. And certainly while these remain, and the dominant interests of society can be expressed by such names as Hudson and California, the old affections of the human heart seeming to have fled from the world, and to linger only in a few of the toiling and striving Brotherhood of

different lands, burning in the Hungarian's and the Roman's breast, and wakening here and there amongst us flashes of the old English fire, we may naturally have cause to fear lest poetry should shortly steal away to some planet in the sky, or some island in the distant seas, and refuse to dwell among the calculating phlegmatics of this very civilized world. But in truth we have no fear. The deep *human* interests of our life can never be lost sight of, and if they were, diviner interests would fill up the void. The trust and aspiration of the religious mind are of perennial growth, and were the lesser perceptions of *fancy*, and the lower themes of earthly joy, all snatched from the poet at once, the diviner element within him would commence a strain that would never be silent more. Inspiration cannot fail till the Deity has either severed our souls from His, or ceased Himself to be.

Look to the facts before us. Let us only glance at the list of our own modern poets, and mark their number and variety. We need not mention the particular merits of Scott or Byron, of whom we have already spoken, and who are certainly by no means among our best modern poets. But Coleridge has left behind him poems of a spiritual nature worthy of everlasting remembrance, showing, as they do, his consciousness of the mysterious, and his sympathy with the sublime and beautiful, to a degree, and in a manner, that had perhaps never been manifested before. Southey, too, has won a deathless fame. In his Thalaba he has given to future generations not merely a singularly vivid picture of oriental life, but a feast for young enthusiasm, and a lesson for Christian faith, that will receive the gratitude of earnest readers to the latest age. Wordsworth, in his Odes to Duty and Immortality, in his lines on Tintern Abbey, in parts of the Excursion, and in many Sonnets, has vindicated for all time the right of solemn thought to expression by the melody of numbers. Shelley's inspiration will live and move the soul for ever. His brilliant creations, his terrible tragedy, his unrivalled Adonais, and his many wonderful effusions of exquisite lyric beauty, can never lose their power to astonish and delight the reader of the English tongue. Keats, too, through his less inspired productions, characterised, however, by their warm glow and rich luxuriance of imagery, is neither dead

nor sleepeth. Tennyson stands unequalled for his fine fancy, his delicate perception of the beautiful, his glowing rhapsodies of feeling, his subtle discrimination of the fine shades of difference separating human characters, and his marvellous power of expressing inexpressible thoughts and states of the inmost soul by talismanic words, which, without describing at all, intuitively put the reader in possession of the oft-remembered feeling so strange and inexplicable even to the most ready sympathy. His burning truths, his pathetic melodies, his quaint fancies, his rich and refined colouring, have made his works treasures of rare hope and promise, to a country just bereft of grander genius of a more *masculine* order, in the youthful and uncompanioned Shelley!—and Tennyson is with us still, and one song in his Princess (Tears, idle tears!)—proves that he can still truly say,

> "O, I see the crescent promise of my spirit hath not set,
> Ancient founts of inspiration well thro' all my fancy yet!"

Kirke White was but in his youth some five and forty years ago, at the time of his premature decay, and had a spirit of rare promise quite in sympathy with our own times. Burns passed away but a short time before him, and long shall Scotland and Great Britain store up and sing his matchless songs. Campbell, by his vigorous writing, his simple ballads, and glowing descriptions, has won a noble fame. Hood has bequeathed to the world a few pathetic verses, and a few sonnets superior, we think, to any in the language. Browning claims an honoured notice and true reverence for his deep thoughts, and powerful imagery, and the ease and boldness of his diction. To Procter (Barry Cornwall) we are indebted for songs of great force, and often of great beauty, and dramatic fragments no less remarkable. William Stanley Roscoe has cast upon the lap of time records of his graceful spirit, too divinely sweet, classical, and plaintive, ever to be lost. Leigh Hunt has written various pieces of real merit. Talfourd, from the cold courts of law, has given us Ion, with its exceeding grace, and gentle dignity, and that sculpture-like composure peculiar to the Grecian stage: and Cowper, Charles Wesley, Heber, Keble, Montgomery, and Milman, have furnished the Christian church with strains of religious

fervour and poetic genius, so moving and melodious,—arrows of the spirit anointed so potently from the tissues of their own conscious being,—that entering, they must deeply thrill the heart of the sinner and the worshipper, so long as sinners and worshippers there shall be to take these inspired words upon their lips.

Living and dead then, we have a very host of poets of our own age,—the greater and the less,—witnesses indubitable to the falsehood of the theory, that advancing time as it leads on the march of science must narrow the realm and lower the rank of the poet.

We might have cited instances innumerable from foreign countries, but surely our own affords a sufficiently ample catalogue. Nor is even this quite complete. Others live to whom we still look for greater and better works than they have yet produced. And across the Atlantic there are writers by whom the title of poet has been fairly earned, and who, using our own language, we are wont to think of as our own. Two at least we may mention,—Bryant, whose compositions are few, but some of them truly graceful, and others evincing power; and the more productive Longfellow, whose harmonious numbers seem sometimes like the wild airs of an Æolian harp, or broken melodies borne upon the night-wind, or the echoes of some sweet symphony lost floating over crested waves. If his Evangeline had been written in any other metre, it might have been an immortal poem; and even as it is, the awkwardness of the metre escapes you as you read, and light and beauty gather round the page. This poem, like many others, exhibits the untraversed regions of song remaining still,—regions absolutely boundless,—where human history is the subject, and all creation the theatre of action, which the poet may deal with as he will.

The name of one venerated man we have omitted from the above list of our modern poets, because we look upon him more as a man of poetic temperament, than as, properly speaking, a poet, although he has written some few lines of real beauty. The friend and frequent host of Coleridge, Wordsworth, Godwin, Hazlitt, Leigh Hunt, Talfourd, and others of well-known names, with a character more interesting than any, and a genius almost more singular, Charles Lamb claims attention, rather as the

author of the Essays of Elia, than as the writer of a fragmentary tragedy and a few sonnets. In his own line he can never be surpassed; his wit and humour, his quick and delicate sensibility, his large and everflowing sympathies, the vein of tender pathos that ran through his most beautiful thoughts, said or written,—the mixture of manhood's intellect with childhood's innocence, — the quaint sweetness and ineffable grace that invested his whole character, have given him a position in the literary world, isolated and remarkable; and while we cannot well class him with our poets, we could not pass, without a comment, one so eminently poetical in taste and temperament.—And when we turn from his works to his life, this judgment only gains strength. His self-devotion *there* was heroic, and yet calmly veiled; it bore the true ideal stamp; and, beside a selfish ungenuine man like Coleridge, he rises up a phœnix of light and glory, and one true line of some simple verse of his, carries more poetic inspiration with it to the reader, than all that Coleridge, in his three volumes, has left behind. Unfortunately for mankind, Lamb's very *failing* connects him with the poet race. For though there have been many bright exceptions, many whom we have mentioned, and others whom we have not, bore or bear the character of men of self-indulgent habits. The many exceptions, especially in latter days, prove the weakness we allude to, to be not inseparable from poetical genius, which it so sadly blights and mars. Lamb had excuses to which none else can lay claim. One purpose the presence of this weakness seems, at all events, to answer to the outlying world. It draws an almost certain line of severance between those who *may* and those who *may not* be open to the direct inspirations of God. We cannot believe that the Father would *ever* continue *consciously* to breathe high and divine thoughts into the mind that had freely surrendered its own dignity, and yielded up the energy of will to the pressing inclination of the hour. In occasional bursts of sincere repentance He might not withhold His love,—but in cases of *habitual* weakness, we cannot suppose Him to assist with His awakened thought, the native genius He has given. Here He must act only in general laws—at a distance from the poet's mind. Hereby

we learn what wonderful resources the mind has, in itself, and in the general laws under which it acts and moves; how the love of beauty can be cultivated, and the imagination enriched, and the feelings of the heart cherished, while still the noblest aid of God is absent. So we may give our truest love, and withhold our truest veneration; for we cannot choose but love all human capacities in themselves attractive,—themselves heavenly gifts; and yet we cannot look without pity and censure upon sin; and self-indulgence in the poet, whether in the grossest form of sensuality, or in the lesser one of intemperance, is not to be excused and smiled away, because passion is strong, or sensation vivid.

And if we turn from Byron or Burns, Coleridge or Campbell, to Shelley or to Wordsworth, or go back to Milton, we find at once that we have entered on a diviner element of being. We think we see in Shelley the direct inspiration of the beautiful, and perhaps that *alone*. He was singularly devoid (as we have noticed in a former article) of that religious reverence which gives harmony to creation and unity to life; but he had a pure and guileless soul, and lived by the light that was in him, though a wandering and mystic life it was. His intellect was peculiar; his character was incomplete; but he was full of noble enthusiasm to serve mankind, and was not given up to sensual indulgences or selfish pleasures; he was a wrong-headed, but pure-hearted, man; and the fervour of his indignation at injustice and wrong was expressed (as in his Adonais) with a brilliancy and power that we can think nothing less than inspired.—With Wordsworth we are upon firmer ground. Of a contemplative and quiet nature, no one can deny, we think, that his poetical *gifts*, (so to designate the natural faculty) are *decidedly*, if not *greatly*, inferior to any of the four poets above mentioned. Had he had the language of Byron, or the sensibility of Burns, or the imagination of either Coleridge or Campbell, his works would, perhaps, be less voluminous than they are, but certainly more inspiring. And had his life been less innocent and holy, unquestionably we should have none of those beautiful passages of elevated sentiment, which he has thrown off, here and there, in a rapt hour of religious musing or prophetic vision. When other

poets of this kind arise, with finer powers and more impassioned soul, walking his round of thought, and cleaving strenuously to his dignity of life, the golden age of poetry will dawn. It may, perhaps, be said that this is impossible; that the very excellences of the poets we most admire arise from that very constitution of their nature, which also works them mischief; but this, we affirm, is a *non sequitur*: that those excellences arise out of a constitution that promises or ensures *temptation*, we may admit, but nothing more: between temptation and habitual sin there is a great gulph fixed, and till we surrender up our deep conviction of man's freedom of will, we will never grant that the greatest poet may not be also a self-restrained, a chaste and temperate man. Genius was given for a great end—the uplifting of the human race towards the sublime perfection of the Unseen,—and we can never believe that God intended it to create the most exquisite delight for the intellect, and leave the moral and spiritual nature unedified and unimproved. The Deity, who is ever teaching us how to turn the forces of nature and the physical powers of man to the most account, cannot regard with complacency the perversion of our noblest mental powers; cannot but desire to see the imagination which conceives the beautiful and sublime, the fancy which lays hold of the finest combinations and the subtlest relations of ideas within or realities without us, and the affections which maintain a perennial flow in the human heart, employed to educate holy feeling, to strengthen moral principle, and lift up man to the true appreciation of his natural worth and his immortal destiny. If Religion is to be an agency of good in the world at all, it must be turned into every channel of powerful influence, and there is none broader or deeper than that of poetry.

That Poetry will become a noble channel of religious influence we firmly believe; that it is becoming so already we have more than one proof before us, albeit only advances towards that which shall be.—Some of these are the volumes cited at the head of this article, and, first, "The Saint's Tragedy," by Mr. Kingsley, a clergyman of the Church of England. It forms, perhaps, the most valuable addition to our dramatic poetry that it has received for many years. We are aware, however, that this is not

saying much in its praise, for with the exception of Coleridge's translations from Schiller, and his fine tragedy of "Remorse," Shelley's "Cenci," and the dramas of Byron, Mr. Justice Talfourd's "Ion," and a few plays of some merit by Mrs. Joanna Baillie, there has been no dramatic production of any kind in our times claiming the attention of the literary student. For even "The Lady of Lyons," perhaps one of the best of Sir E. L. Bulwer Lytton's writings, and remarkable for its dramatic effect, is rather interesting on the stage than valuable in the library.—"The Saint's Tragedy" is a work of quite another character; and by its very nature, its length, its class of incidents, the serious thought and deep feeling scattered through its pages, is quite unsuited, as it was evidently undesigned, for public representation. We mean, of course, by this no disparagement to theatrical performances: we are grateful to all who endeavour to raise the moral influence and dignity of the stage, for we are disposed to believe that it might be made a powerful instrument for educating and refining the public taste; but it will at once be confessed that the aspirations of religion are too sacred to be shouted into the public ear: for ourselves we must say that even where these are not approached, words are sometimes uttered on the stage that it is painful to hear there; not because they are not noble and beautiful expressions of what the mind thinks or the heart feels, but because they are concerned with thoughts and emotions whose natural privacy should never be violated. This feeling may arise from the English reserve under which we are educated, but still it must carry some weight with it, belonging as it does to the most cultivated and refined.

Mr. Kingsley's tragedy is the deeply interesting drama of a religious life.* Though our concern now is with it only as a *poem*, we may fairly give an opinion upon the characters, which seem to us admirably conceived and sustained: they prove that the author has not studied in vain either human nature in general, nor the times and persons of which he writes in particular. The character of Elizabeth, Princess of Hungary and Landgravine of Thuringia —the subject of the piece—the saint of the Tragedy—is an

* We recommend to the notice of our readers the admirable Preface by Professor Maurice.

historical character powerfully portrayed, and undoubtedly, we think, the masterpiece of the drama. Her fervid enthusiasm, her dominant piety, her uncontrollable benevolence, her fearless simplicity, and, more than all, perhaps, her strong human affection, are brought out with a vividness, force, and beauty, that could scarcely be surpassed. Her story, as here presented, contains a noble lesson on the right of natural instincts to dictate its duties to the human soul, and further reveals our nature to us with such a fearless truthfulness, that prudery might well study it, and blush to confess its own weakness and unhealthy thoughts.—The character of Lewis, too, simple, affectionate, and easily moulded,—that of Conrad, stern, ambitious, prejudiced, devoted,—and that of Walter of Varila, a man of strong sense and noble nature, but (as it is expressed in the Introduction) "exhibiting the healthy animalism of the Teutonic mind," rather than any more spiritual feature,—all seem to us true types of character, carefully and powerfully drawn.

To these characters, and the simple air of reality pervading the history, and to the well-chosen language, the play owes its interest, for it is quite devoid of intrigue, there is no plot or counterplot, it has the even flow of a sad, powerfully-depicted drama of unvarnished human life.

We regret that the tragedy did not close with the fourth act. After the death of Elizabeth all interest is gone: and as no material end seems to be gained by the arrangement of the later acts, as the action of the play, after the close of the second act, is not marked by any obvious division, these four might have been extended into the legitimate five, or contracted into the allowable three, without adding to or taking from the poem, or breaking the continuity of the several parts.—In regard to the rhythm, it seems to us a mistake to have introduced several varieties of metre. Besides the prevailing blank verse, there are Alexandrines used (as in pages 145-6), and also those still longer lines which Tennyson, with the additional use of rhyme, has employed with so much effect in his "Locksley Hall;" there is an example of this in page 69. In pages 128-9, an irregular metre like that of an ode is employed with rhyme;—it might, however, be intended for a song. There are several songs of more or less beauty scattered through

the play; those in pages 73 and 103 are particularly worthy of notice; the proem, too, is spirited. We must give a specimen or two of the poetry. Here is the speech of Lewis when informed of the love of Elizabeth, with whom he had been familiar, and to whom he had been betrothed from his youth, and who for want of his protection is suffering repeated insults from the courtiers:—

"*Lewis* Loves me! Henceforth let no man, peering down
Through the dim glittering mine of future years,
Say to himself, 'Too much! this cannot be!'
To-day, and custom, wall up our horizon:
Before the hourly miracle of life
Blindfold we stand, and sigh, as though God were not.
I 've wandered in the mountains, mist bewilder'd,
And now a breeze comes, and the veil is lifted,
And priceless flowers, o'er which I trod unheeding,
Gleam ready for my grasp. She loves me then!
She, who to me was as a nightingale
That sings in magic gardens, rock-beleaguered,
To passing angels melancholy music—
Whose dark eyes hung, like far-off evening stars,
Through rosy-cushion'd windows coldly shining
Down from the cloud-world of her unknown fancy—
She for whom holiest touch of holiest knight
Seemed all too gross—who might have been a saint,
And companied with angels—thus to pluck
The spotless rose of her own maidenhood
To give it unto me!"—Act I. Scene 2, p. 54.

Here is the exclamation of Elizabeth, when she hears of this avowal:—

"*Elizabeth.* Tell him—tell him—God!
Have I grown mad, or a child within the moment!
The earth has lost her grey, sad hue, and blazes
With her old life-light; hark! yon wind 's a song—
Those clouds are angels' robes. That fiery west
Is paved with smiling faces. I am a woman,
And all things bid me love: my dignity
Is thus to cast my virgin pride away,
And find my strength in weakness."—Act I. Scene 3, p. 61.

Here is a fine passage from Act II. Scene 3, p. 76—

"*Eliz.* Oh! contemplation palls upon the spirit,
Like the chill silence of an autumn sun:

While action, like the roaring south-west wind,
Sweeps laden with elixirs, with rich draughts
Quickening the wombed earth.
Guta. And yet what bliss,
When, dying in the darkness of God's light,
The soul can pierce these blinding webs of nature,
And float up to the nothing, which is all things—
The ground of being, where self-forgetful silence
Is emptiness—emptiness fulness—fulness God,—
Till we touch Him, and like a snow-flake melt
Upon His light-sphere's keen circumference!"

With the two following lines beautifully descriptive of winter, we must reluctantly close our notice of this very interesting little volume, returning Mr. Kingsley our sincere thanks, and expressing the hope that he may not leave us long without another occasion for drawing attention to his great merits.

"*Eliz.* The storms are still.
Beneath her eider robe the patient earth
Watches in silence for the sun: we 'll sit
And gaze up with her at the changeless heaven,
Until this tyranny be overpast."—Act III. Scene 3, p. 162.

Mr. Trench's story of Justin Martyr is a short poem of great merit. It is too long to give in full, and we should be afraid to spoil its unity and charm by quoting a part of it, when it is all so well worth perusal. The truth of the feeling, the beauty of the language, and the deep spiritual meaning it contains, all claim for it a high place among the poems of the present day. It belongs to the highest kind of poetry, and is in truth of a rare quality. Unfortunately it stands alone in the volume; no other poem having by any means equal merit. Mr. Trench belongs to Wordsworth's school of poetry, and has fallen into the same error of publishing too much. He gives us indirectly to understand in some pleasing lines which close the volume, that he does not write for fame, but for a sacred influence. We believe, however, it is a mistake to suppose that religious feeling or thought will influence through poetry, merely as metrical composition, when of an indifferent or third-rate description. Poetry is not read by every one; only by those who would throw aside at once

serious poetry, not inspired either by the glow of enthusiasm, or the hues of fancy, or the pictures of imagination. Such a simple story as that of Honor Neale would tell much better in prose. As a tract it might be useful, especially among the poor. Here Mr. Trench, whose view of things is always spiritual, follows Wordsworth too closely: but what has not inspired himself is not likely to inspire another. "The Monk and Bird," and "A walk in the Churchyard," contain beautiful verses well worth perusal: they exhibit at once the style of the author's writing, and the religious aspect in which fiction or truth alike strike upon his serious mind.* Among the many sonnets we would refer the reader to five addressed to a lady singing (p. 136-9), and two upon the perception of beauty everywhere (p. 142-3), containing some of Mr. Trench's best thoughts, expressed in his best language. The two last verses of an Ode to Sleep are beautifully descriptive (vid. p. 152-3). At the close of the volume, where the verses are exclusively religious, the author seems to us most at home (see especially p. 260-3). There are some beautiful verses in the Day of Death, to which we would particularly direct attention (p. 264). As a specimen of Mr. Trench's descriptive power and spiritual application we select the following sonnet: —

"THE HERRING-FISHERS OF LOCHFYNE.

"Deem not these fishers idle, though by day
You hear the snatches of their lazy song,
And see them listlessly the sunlight long
Strew the curved beach of this indented bay:
So deem'd I, till I view'd their trim array
Of boats last night,—a busy armament,
With sails as dark as ever Theseus bent
Upon his fatal rigging,—take their way.
Rising betimes, I could not choose but look
For their return, and when along the lake
The morning mists were curling, saw them make
Homeward, returning toward their quiet nook,
With draggled nets down hanging to the tide,
Weary, and leaning o'er their vessels' side."—P. 68.

* We cannot understand why Mr. Trench always uses the word spiritual as one of *two* syllables, where the metre is constantly broken by its introduction: of this there are numberless examples.

The same serious spirit, the same sense of mystery, the same vivid consciousness of the Unseen in which we live and move—which characterises the poetry of Mr. Kingsley and Mr. Trench—appear in the little volume called "Ambarvalia." Mr. Clough's poems are generally more remarkable for spiritual than for poetical thought: his language is often stiff, and his ideas obscure and involved, which makes it difficult to arrive at his meaning. He is too fond of alliteration, e. g. these phrases occur—"mortal moral strife," "sure assured," "seem to see," "dare not dare," "wills thy will," "priceless prize," "dreamier dreams," "bloomiest bloom," "primal prime,"—and are certainly awkward and unpoetical. The first poem we like much: it expresses well that mystery in which the mind gets entangled, in endeavouring to solve the difficulties which press upon the thoughtful. "Qui laborat orat" (p. 18) contains a true and noble thought, and reveals (as do all this writer's lines) a lowly yet manly and aspiring soul. He has more concentration of thought and expression than Mr. Trench, more metaphysical subtlety, but less of the poetical temperament. There are some fine verses under the title "When Israel came out of Egypt" (p. 23). The most poetical piece of all we think is the "Silver Wedding" (p. 28), celebrated in Germany when a couple have been married five-and-twenty years;—there is true poetical and deep human feeling in it, doing justice to our highest nature: it is too long to quote here. "Qua cursum ventus," (p. 50,) lines suggested by a common experience of life, is forcible and earnest as well as beautiful; it is the only specimen we have space for in this short notice of Mr. Clough's miscellaneous effusions, where, it must be candidly allowed, that a want of taste is sometimes discernible:—

"As ships, becalmed at eve, that lay
With canvass drooping, side by side,
Two towers of sail at dawn of day
Are scarce long leagues apart descried;

When fell the night, upsprung the breeze,
And all the darkling hours they plied,
Nor dreamt but each the self-same seas
By each was cleaving, side by side:

E'en so—but why the tale reveal
Of those, whom, year by year unchanged,
Brief absence joined anew to feel,
Astounded, soul from soul estranged?

At dead of night their sails were filled,
And onward each rejoicing steered—
Ah, neither blame, for neither willed,
Or wist, what first with dawn appeared!

To veer, how vain! On, onward strain,
Brave barks! In light, in darkness too,
Through winds and tides one compass guides—
To that, and your own selves, be true.

But O blithe breeze! and O great seas!
Though ne'er, that early parting past,
On your wide plain they join again,
Together lead them home at last.

One port, methought, alike they sought,
One purpose hold where'er they fare,—
O bounding breeze! O rushing seas!
At last, at last, unite them there!"

We should say that Mr. Burbidge (to repeat an expression already frequently used for want of a better) had a more decidedly poetical temperament than Mr. Clough: his lines throughout flow more easily, and there is more fancy and imagination, and less metaphysical thought in his poems. We like his opening lines upon Florence, and others further on in the volume (p. 95 and 116), suggested also in that city, when walking in the Boboli gardens. The following lines entitled "Portraiture" (p. 71) we think must be admired:—

"With pain her gloomy eyes did she uplift,
That woman old; with many a tempest torn,
Of sins and sorrows spent ere we were born,
Her sallow brow appeared, o'er which a drift
Of massive snow-white hair lay dead and still,
Or flew across, by fits, without her will.

There stood before her the enquiring child:
On the frail lids of his uncentred eyes

Lay no weight heavier than a light surprise;
His tresses soft, like silver undefiled,
Hung on his sunbright face, or in a (floating) wreath
Clouding his lips, moved mildly with his breath.

A rock long-bearded with cold weeds marine,
In whose wet womb the ocean-creatures sleep,
Should it uplift its scalp above the deep,
Were likest to that hellish Woman seen;
But he a Lily stood, caressed by eve,
And which the morning mists are loth to leave."

The verses next following, p. 72-79, have all more or less beauty in them. Those headed "Aspiration" are in the finest style of serious thought, in Mr. Clough's manner, with more simplicity of diction than he generally employs, although we do not comprehend the fifth verse. We should like to know what Mr. Burbidge would express by "the crystal wall." He assumes rather a free poetical license (in p. 81) where he uses or rather *coins* the word "promont" for promontory—

"As I upon a promont of creation,
Where it o'erjects the inexistent void
Had stood to gaze," &c.

This is not like Mr. Burbidge's usual style of writing, and ought to be avoided. Some lines entitled "I would" (p. 87) are well worth perusal for the beauty of the sentiment expressed in them. From among many sweet verses, and some beautiful sonnets, animated by a lofty religious spirit, we can only further select the following specimens of the Burbidge's poetical powers (Sonnet, No. XIV. p. 143; and No. VII. p. 154), to close our review:—

"Searching the skiey depths all night in vain,
The starry seer hath known this mystery—
That the sky orb, which over half the sky
Had baulked his chase and mocked his utmost pain,
Oft (haply while the daylight poured amain
Into the empty concave of the night)
Has slipped into his glass, as clear to sight
As the one Tree that stars a glassy plain.
So is it known that some secretive Truth
Which Thought and Patience strove in vain to find,

Just when Despair and Doubt were swallowing all,
Hath dropped into the heart without a call,
Conspicuous as a Fire, and sweet as Youth,
An everlasting stronghold to the mind."

"Lord, I will take no comfort but of Thee.
I had an earthly plant—a pleasant vine,
From whose dear grapes I pressed delightful wine,
That made my heart as merry as could be.
Thine anger hath cut down that cheerful tree;
Or, at the least (for yet I but divine),
Thou hast cut off its joyful fruit from me,
And made its precious shade no longer mine.
Shall I then murmur? If my road henceforth
Lies hot before me, wearisome and bare,
And no green garland, twined among my hair,
Will guard, as it was wont, my tortured eyes,
What then? The sweeter after this stripped earth
Will be the shady rest of Paradise."

Art. VI.—SHORT CONCLUSIONS FROM THE LIGHT OF NATURE.

Short Conclusions from the Light of Nature. London: F. & J. Rivington. 1849.

The tendency of modern theology to recede from mere textual criticism and interpretation into the discussion of religion in its first principles is visible on the very face of the Publishers' advertisements. Here is another contribution to the ever-increasing class of works, which, while preserving a reverential attitude towards Christianity, pass behind it in quest of the ultimate grounds of faith, and aim to discover, in the structure of the universe and the course of human experience, some real traces of the leading truths verbally embodied in historical Revelation. This little volume belongs, however, to the age more in its subject than in its method. It contends for the fundamental doctrines of a natural Theism,—"the existence of an Intelligent and Personal Creator, and a Future Life for man,"—by such arguments as approved themselves to the old school of latitudinarian divines. Of that sagacious and admirable class of men the author indeed continually reminds us by his good sense, his clear statement, his humane feeling and truthful simplicity. Something more of metaphysical penetration, and an understanding differently (we do not say more wholesomely) trained, would be requisite in order to reach the subtle difficulties with which modern philosophy perplexes the great system of Theism: but the reader who is happy enough to know nothing of these, and for whom Spinoza and Hegel have lived in vain, will be pleased to revive, in the pages of this treatise, his pleasant remembrance of Paley and Crombie. As the work contains only in outline, reasonings which, in a more ample form, the author reserves for future publication, we shall take example from his brevity, and touch at present only on one or two characteristic points.

When we open a book of philosophical pretensions, we are in the habit of testing it, in the first instance, by this

inquiry; whether the author can hold his balance between the antagonist tendencies of Idealism and Realism. If he cannot,—if he is so fascinated by the claims of either as to encroach upon the rights of the other, it is easy to foresee the entanglements into which every course of reasoning upon the nature and origin of things must lead him. Our author has not escaped the common snare. He is not only a Realist, but a Materialist,—that is, he maintains "that mind is the result of the organization of what we call matter." With this doctrine it has always been impossible to establish Theism in any hearty and permanent union. The reason is obvious. The Materialist follows one order of deduction; the Theist, just the inverse,—the data and quæsita changing places. The one demands material forces in order to account for mind; the other asks for a Mind in order to account for material forces. The one sees in physical power the real ground of the actual phenomena of nature, and traces it in its ascent through the gradations of being, till it culminates in Intelligence and Will; the other treats Thought and Purpose as the primitive reality, and follows it down in its descent through the material universe which it animates and directs. These two modes of thinking cannot co-exist except in uneasy and precarious combination. Once allow that the force of attraction and repulsion is adequate to the production of *mind*, and what more does the Atheist want? The highest class of phenomena being made over to it, is there anything to which it is not competent? It is a mere accident that saves this kind of Theism from complete surrender. All that *now* goes on in the universe, following the path of regular law, might accommodate itself readily enough to the atheistic theory: and if the present order, or any other on which it depends by natural links, had always existed, there would have been no opening for the admission of a Divine Will. But happily there occur breaks in the adamantine chain which science cannot yet complete: and until the *origin of species* is better accounted for, and Sir C. Lyell's geological theory more fully established, there will remain room for the Supreme agency at the *Formative Epochs*, in which the old idea of *Creation* is still permitted to take a scattered refuge. When Divine power is thus resorted to, merely to fill in a hiatus in the naturalist's re-

cord of the world, to work the philosophers' ferry-boat till they can build a bridge, such residuary Theism appears to us to lose almost all religious value, as well as all permanent security. We are the more surprised at our author's materialistic hypothesis, because, in a subsequent discussion of the question of Liberty and Necessity, he gives his verdict in favour of Freewill. It is not easy to conceive how the contingencies of freedom should issue from the necessary developments of organized matter. Such a combination of doctrines is certainly peculiar, and deserves from our author a few pages of further exposition and defence.

"The principal object of the writer," however, "is to place in somewhat new light the evidences of a *future life*, without which hope even the existence of an intelligent Governor of the universe would be, to most minds, no more than a high, but barren speculation."—Preface, p. iv. This object is attempted, mainly, by so balancing the cases of preponderant suffering and the oppressive mass of moral evil in the world against the counteracting evidences of divine justice and goodness, that the hypothesis of a future life shall step in to turn the scale, and transfer the whole weight of phenomena to the side of positive faith. We sincerely admire and envy that openness of heart to hope and trust, which, from the very deformities and wickedness of men, from the bitterest anguish of the world, from the brutal scenes where childhood is spoiled and woman loses her nature and all human capacity is turned into corruption, can evolve the august belief in immortality. But the argument, that without a second life the arrangements of the first would be too bad to admit of any defence, is one on which, we must confess, we can never dwell without anxiety. The spectacle of sunk and degraded humanity, instead of leading the imagination from the failure of the present to the promise of an hereafter, is apt to oppress and overwhelm the faith in a divine future. It is not from the dark anomalies, but from the clear glories of this world that we are inspired with hope of another; and did all men exhibit the soul of a Pascal and the life of a Howard, every formidable plea of doubt would be removed. And the rule holds, we think, not merely of the moral deformities, but also of the external inequalities, of men. Those

who are *least* sensitive as to these inequalities, who are prone to no complaint for themselves or others, who are the last to interpret the mysteries of suffering into the semblance of injury, are just the persons most susceptible of the everlasting hope. They whose world would look best without it are precisely the souls most sure to live with it. They would not recognise the premiss from which our author's reasoning proceeds,—that every being has a *right* to a certain preponderance of enjoyment from his Creator; nor, if they did, would they admit that happiness, especially that of a free and spiritual nature, was any sort of objective quantity, dealt out upon the person *ab extra*, and capable of estimate as the graduated measure of the Divine character. We do not indeed deny that, under certain conditions, the argument from the anomalies of life may acquire a just force. Where (as in the extreme case of Christ) the divinest excellence coalesces with the saddest lot,—the lot which threatens to render the excellence abortive,—the human heart seems incapable of resting in a catastrophe so mournful, and through its own best sympathies obtains insight into the ulterior purposes of God. The argument however requires, we think, delicate handling; and will avail only when the compassionate and the reverential affections centre upon the same object.

When our author quits this ground, and contends that within our human nature itself are comprised faculties obviously *prospective*, when he traces in Conscience and the religious Affections a clearly prophetic attitude, all our hesitation vanishes, and we give him hearty assent. Features like these, which are *too good* for this world only, give us an assurance which we could never derive from those which are *too bad*. Both alike may be scientifically *out of fit* with the system in which they appear: but the evidence depends not on this character of *incongruity*, but on that of inherent *excellence and beauty*. Of this excellence and beauty we are assured by our own self-consciousness; and in carrying the appeal thither we reach the genuine sources of devout faith. It may be doubted whether criticism of the external universe and life, by rules of scientific judgment, can ever be made to yield any true religious belief. Such a process, though ultimately indispensable for every open-minded man, is in its proper place

only when subsidiary to an original personal faith subjectively evolved from the Conscience and Affections. Hence the qualified and uneasy assent which alone we can give to the Analogy of Butler, the Theology of Paley, and the Short Conclusions from the Light of Nature. The truths of religion appear to us to possess a higher certainty than that trembling balance of probabilities which the method of these treatises allows: and accordingly most readers, we believe, rise from such works with a feeling of disappointment that their faith cannot take higher ground, and has to plead for its existence with so ingenious a caution. Where however the attack is so various as in the present age, defence of every kind may find a welcome and a use: and we shall be glad to meet again,—and for a longer intercourse,—the sensible and benevolent author of the volume which has called forth these remarks.

Art. VII.—POPULAR CHRISTIANITY.

Popular Christianity. By F. J. Foxton. Letter from the Author to the Editors.

To the Editors of the "Prospective Review."

Gentlemen,

My reviewer, in the last Number of the "Prospective Review," has mistaken both my meaning and my position, in supposing either that I recommend a dishonest adherence to the establishment, to those who are convinced of its vital corruption, or that I am myself in a position of such degrading compliance. I resigned my preferment in the Church more than two years ago, nor should I have considered it decent to have assailed the Church whilst I was wearing her livery.

From those who entertain the opinions expressed in my book, common honesty, of course, requires immediate secession, but there are many of the clergy of the establishment whose heterodoxy is far less pronounced than mine, and who seem to believe that "new wine" may yet "be put into old bottles." From such I have required that they should at least protest against what they believe to be false or obsolete in the doctrine and discipline of the Church, even whilst they continue within her pale. In perfect strictness there is no clergyman in the Church who does not in some way or other violate his oath of ecclesiastical obedience, either in regard to doctrine or discipline, and a further extension of this notorious laxity would involve no *fresh* violation of principle or consistency. Both the doctrinal system and the discipline of the Church are in such a chaotic condition that it has become extremely difficult to decide as to what is real and what only nominal, in the province of ecclesiastical authority.

Without doubt, there are at the present moment within the Church those conflicting elements of opinion that will insure its ultimate dissolution, and an honest expression of them is assuredly far more desirable that their suppression. I have only to add, that desiring as I do the dissolution of the Established Church, I would still prefer that it should perish by exhaustion and natural decay, rather than by a sudden and violent death.

I trust you will indulge me so far as to find a place for my letter (or the substance of it) in the forthcoming Number of the "Prospec-

tive Review." Your treatment of the literary character of my very imperfect book was only too indulgent—my present purpose is, solely, the vindication of its moral bearings.

I am, gentlemen,
Your obedient Servant,
FRED. J. FOXTON.

Cheltenham, Dec. 8, 1849.

We are happy to receive from Mr. Foxton this statement of his views on the morality of Opinion; though we can look with no satisfaction, and no hope, "on a further extension of a notorious laxity," which "would involve no *fresh* violation of principle or consistency." We think this application of the rule, 'he that offends in one point is guilty of all,' very much like the letting out of water. We desire, however, to permit Mr. Foxton to speak for himself, and have no wish to re-cite the passages from his book which seemed to us to require grave expostulation. The ground of that expostulation was not the supposition of his own continued adhesion to the Church of England, but the advice he offers to heretical clergymen, which any one, who pleases, may see on page 497 of our last Number.